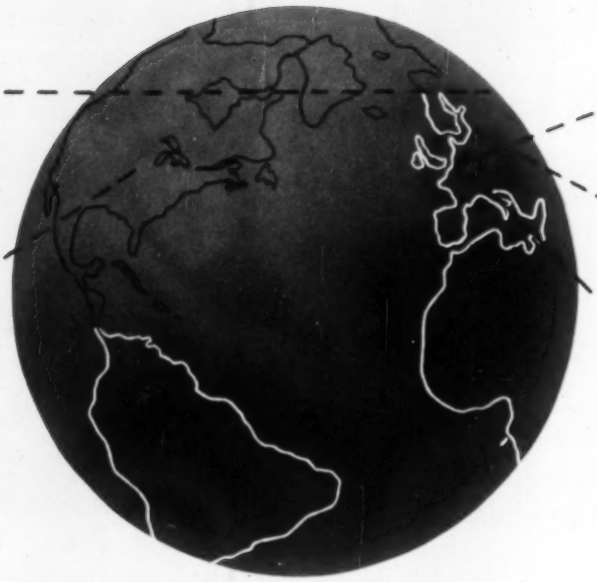
ENGINEERING
NEWS-RECORD

World Progress Toward Better, Bigger Dams



A notable group of articles by five distinguished authors p. 31

A McGRAW-HILL PUBLICATION

E B POWER
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Penstocks for Mountain Home—CB&I built three, 22-ft. diam. penstocks for the Idaho Power Co.

Wherever water is diverted, harnessed or stored . . . you'll find the creative *craftsmanship in steel* of CB&I at work.

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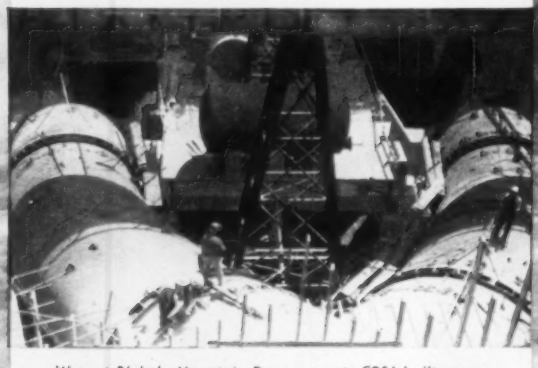
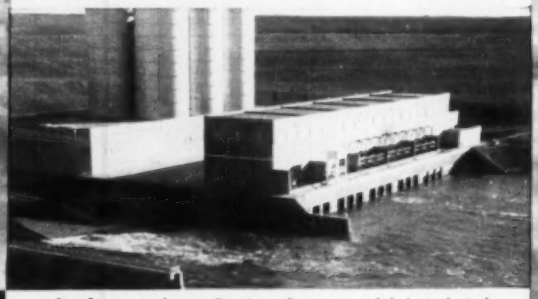
This *single responsibility* service, backed by our four fully equipped and strategically located fabricating plants, is the reason why seasoned operators and contractors *rely on CB&I* to design, fabricate and erect to the most rigid specifications.

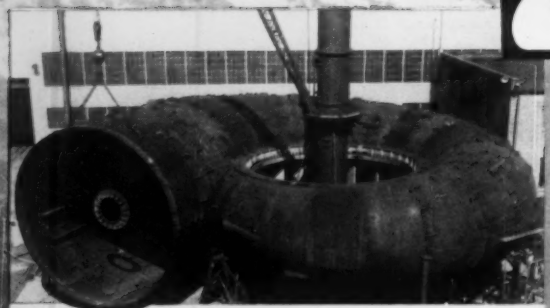
Write the nearest CB&I office for details. Ask for the *Blakely Mountain Dam* story.



Wye at Blakely Mountain Dam connects CB&I built power conduit, two penstocks and 149-foot high surge tank.



Six Surge tanks at Garrison Dam were fabricated and erected by CB&I to help control turbulence of the "Mighty Missouri" River. They are 65 ft. in dia. by 135 ft. high.



CB&I *Shop Fit-up of T-1 Scroll Case*—one of the largest ever built—for Noxon Rapids Dam. T-1 alloy construction of 24-ft. diam. case saved 50% in plate thickness. Re-assembled and welded at site by a CB&I crew.

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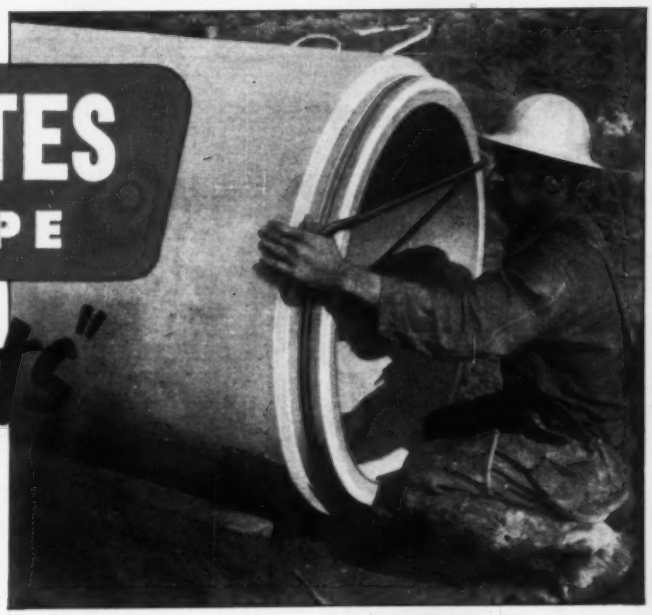
with

"Flex-Joint"

handles



HIGH head pressures—STOPS infiltration and exfiltration

United States Concrete *Flex-Joint* pipe features an improved flexible gasket of O-ring design made of either rubber or neoprene. The Gasket seats securely in a groove in the pipe tongue. As pipe is coupled the Gasket forms a virtually water-tight, yet flexible, compression seal on four sides of the Gasket, capable of withstanding head pressures of 50 ft. and above. Gaskets are quickly assembled to pipe by merely "snapping" them into the tongue grooves. No adhesives are required.

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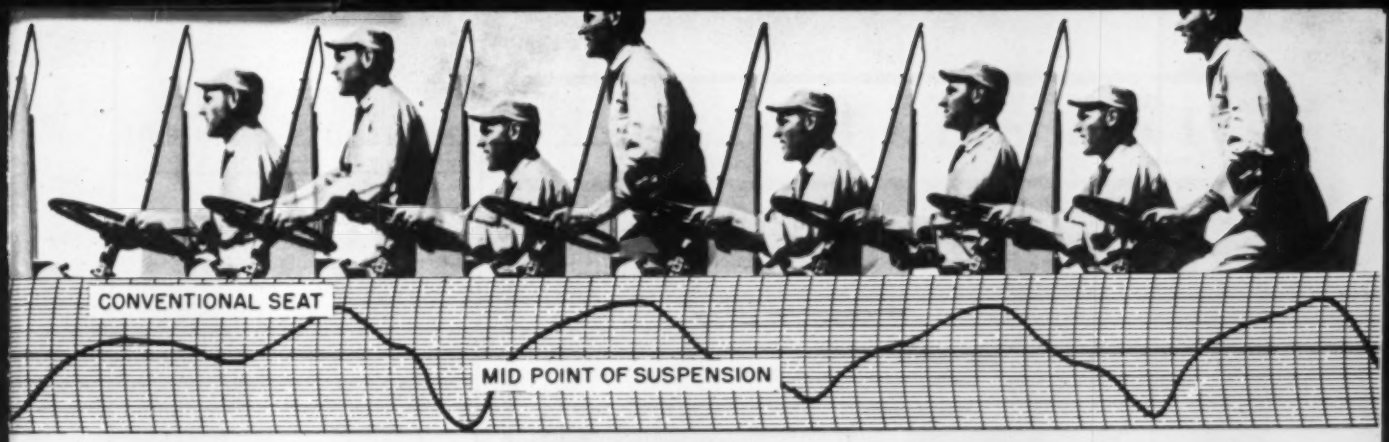
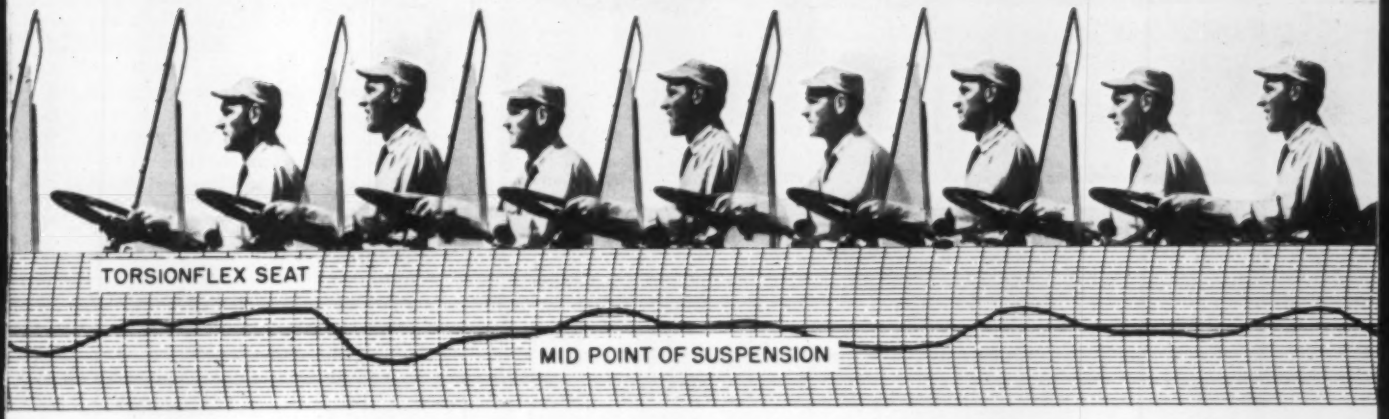


Operator efficiency increases with . . . the new Caterpillar Torsionflex Seat



New Torsionflex Seat for Caterpillar wheel Tractors increases operator efficiency and comfort—provides a "highway" ride in off-highway conditions. Note the difference between the ride in the Torsionflex Seat and the conventional seat, as illustrated by this graph made over the same rough test course.

The Torsionflex Seat is just one of many new features introduced by Caterpillar to help increase earthmoving production!

Over the years Caterpillar has been the leader in improving earthmoving equipment with one aim in mind: *to move more dirt faster at lower cost.* No advance, from strengthening a 7-pound piston to redesigning a 30-ton rig, has been overlooked to increase the efficiency of Caterpillar-built machines, as well as the efficiency, comfort and safety of the men who operate them!

Now, in the new Torsionflex Seat, Caterpillar introduces a new concept in wheel tractor seat suspension—to give the operator maximum comfort over the roughest terrain. The new seat conserves his energy, lessens his fatigue, enables him to do more work per shift.

Test course proves superiority of Torsionflex Seat

The graph here shows the improved ride made possible by the Torsionflex Seat. Two rubber-tired machines, one with this new seat and the other with the conventional seat, were run over the same rough test course at the same speed. The lines in the graph were plotted by instruments attached to the operator. The horizontal component of the lines represents forward travel by the operator, while the vertical component represents his up and down motion. Note the big difference in the ride!

The new seat is just one of many improvements, large and small, being made constantly by Caterpillar throughout its line—tractors, scrapers, motor graders, other earthmovers. For modern, heavy-duty equipment that will increase your production and lower your costs, see your Caterpillar Dealer!

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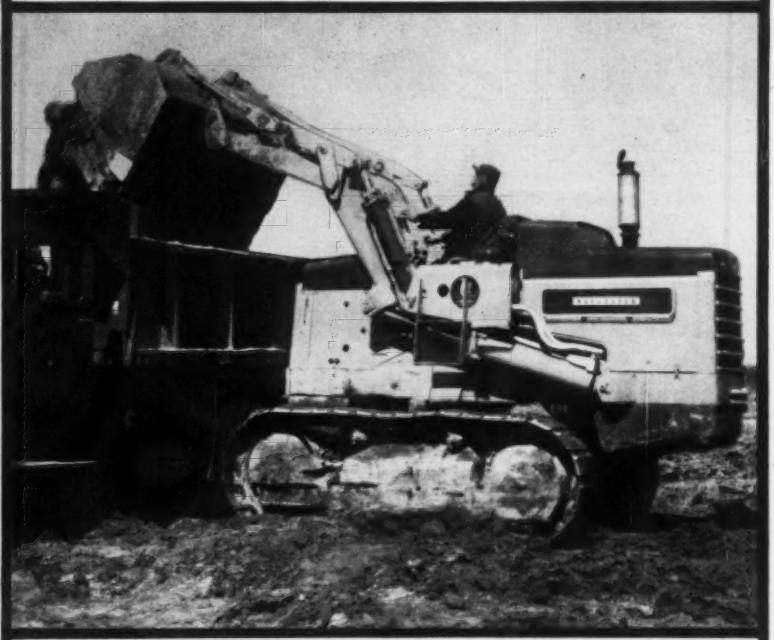
LEADER IN FEATURES THAT INCREASE PRODUCTION AND LOWER COSTS

"I can load a 10-yd. truck



from stockpile in 1 minute"

"And I can dig an average basement in 3 hours less time!" That's what John Beniger of Sheboygan, Wis., says about his "PAYLOADER", and adds, "I bought my Model 12 a year ago and soon found I had a new kind of tractor-shovel under me."

This Model 12 "PAYLOADER" is the first unit-built tractor-shovel specifically designed for shovel work, not a tractor attachment. This 1¾-yd. machine is a driver's dream in operating ease, riding comfort, visibility and safety and outproduces conventional "tractor-shovels" of even larger bucket capacity.

BALANCE — Rear engine mounting on the Model 12 is the big difference. It counterbalances the bucket load and distributes machine weight over the entire track length . . . gives more traction and stability for digging, carrying and dumping.

SPEED — Power shift transmission and power-steer permits effortless, on-the-go shifting and steering (no foot brakes) for instant response and forward or reverse speeds to 10 mph.

VISIBILITY — Operator is comfortably seated ahead of the engine where he can see what his bucket is doing and where he's going, at all times.

THE COMPLETE STORY — of the Model 12's remarkable "built-in" traction, stability and balance is fully explained in an attractive 8-page bulletin. Write for your copy today. The Frank G. Hough Co., 772 Sunnyside Ave., Libertyville, Ill. 8-C-4

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Reader Comment

PHA Poses Handicaps

SIR—Red tape and unnecessary procedures are discouraging handicaps to consulting structural engineers engaged in design work for U.S. Public Housing Authority projects.

The consultant is retained by an architect who holds his commission from the local housing authority and his immediate responsibility should be to that architect. Instead the engineer is confronted with PHA directives, questions, conferences and other time consuming procedures. PHA projects compare unfavorably with usual private commissions, since the fee structure is likely to be similar.

Whatever the original intent, the structural review of the technical division of the PHA with a relatively small staff, necessarily must be superficial. The results of such reviews appear to be:

- With experienced consultants—merely to consume much time in explaining established and professionally accepted methods to the reviewers, a procedure not likely to produce any project improvements.
- With consultants of less experience—to encourage overly conservative designs to avoid errors on the "weak" side.
- Finally—to leave responsibility for the basic quality of the design precisely where it started—with the consultant.

It appears to this consultant that many more important functions could be served by the PHA technical division, for instance.

- To keep abreast of the progress in domestic techniques. A case in point is the change in the American Concrete Institute code which permits ultimate strength design; this presents an available economy in multi-story structures that should be advocated rather than overlooked.
- To keep abreast of progress in foreign techniques that might be applicable in the U.S. Precasting procedures in England, the Scandinavian countries and the Soviet Union are other examples.

Engineering News-Record welcomes expression of opinions from its readers. Comment should be as brief as possible and pertinent to subjects of current construction importance. Letters should be addressed Editor, Engineering News-Record, 330 W. 42nd St., New York 36, N. Y.

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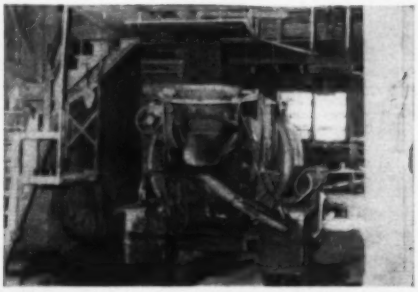

Concrete containing Maracon being loaded into a Heiser Ready-Mix Company truck.

Concrete containing Maracon being poured by Lotz Sand and Gravel Company in the construction of a new Marathon Corporation warehouse at Rothschild, Wisconsin.

With Maracon you can:

1. LOWER CONCRETE COSTS:—
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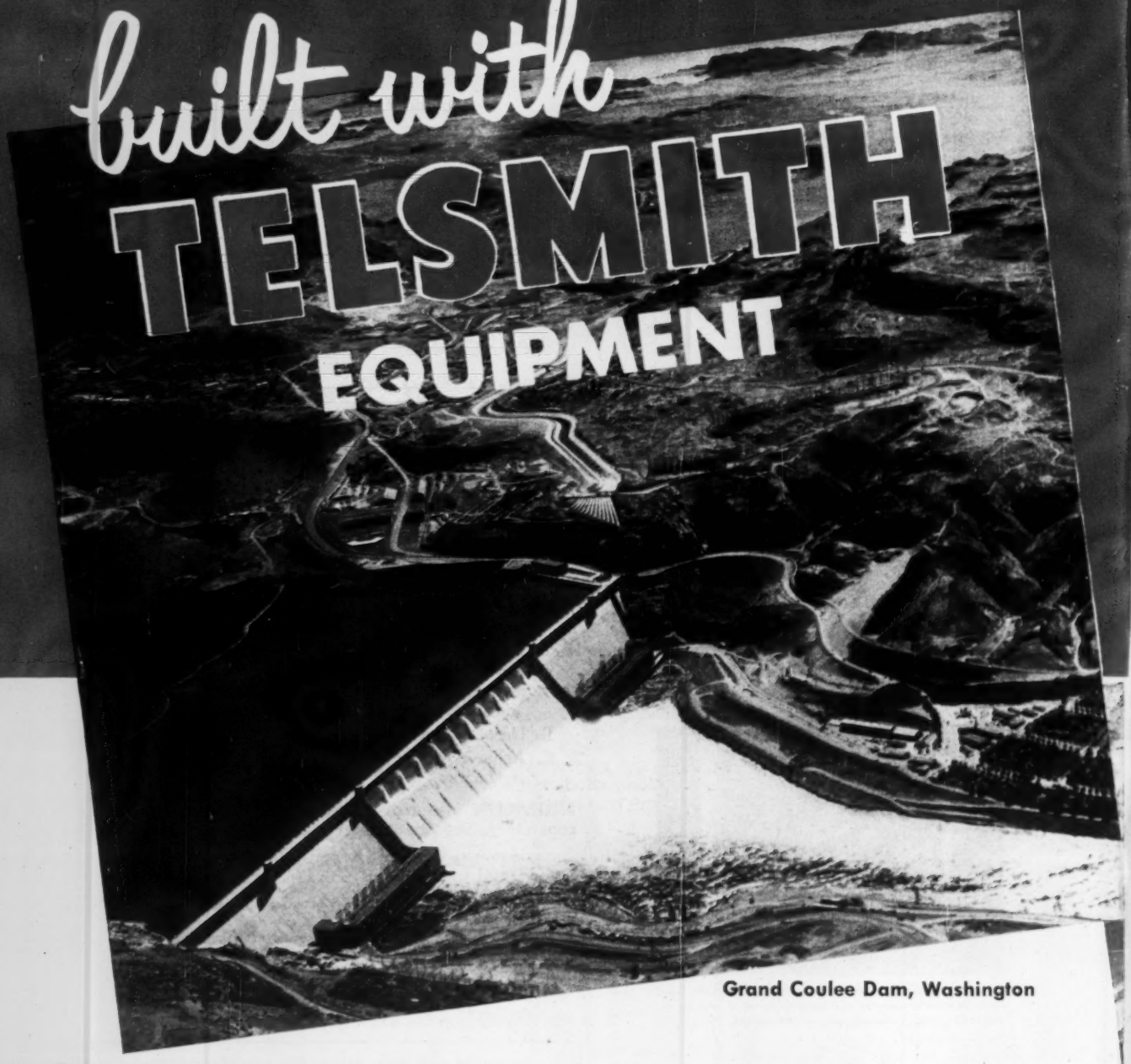

Grand Coulee Dam, Washington

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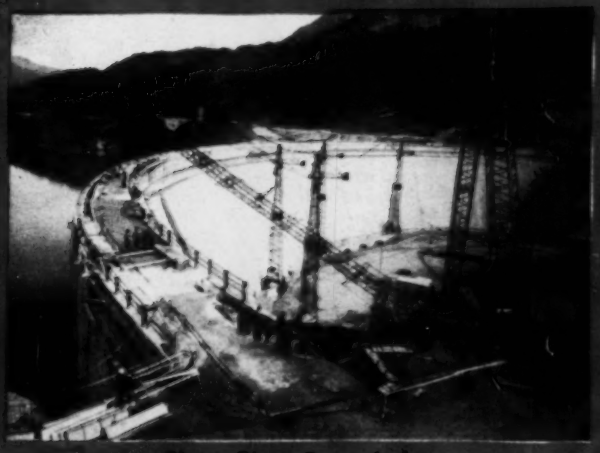
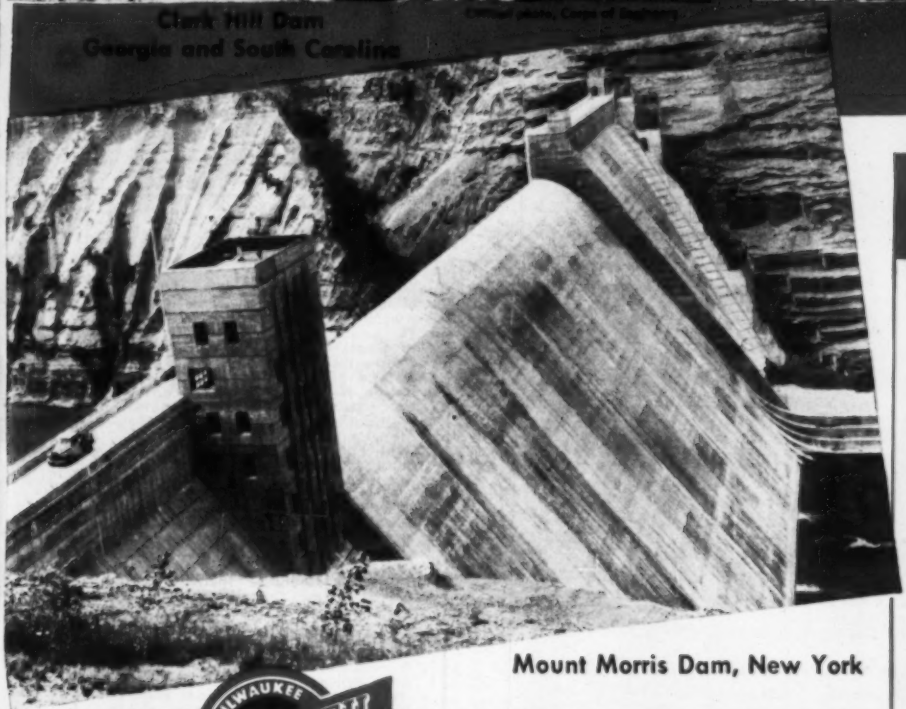


Piave River Dam, Italy



Mount Morris Dam, New York

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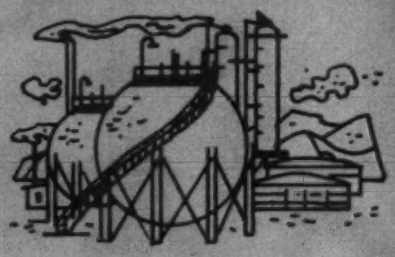

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Verti-Line pumps occupy as little as 1/5 the space of ordinary horizontal pumps of similar capacity.

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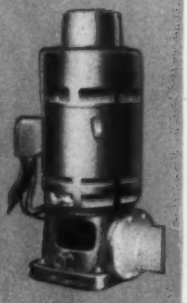

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. . . Reader Comment

• Most important, the USPHA has an unequaled opportunity to provide a tremendous contribution by maintaining a continuing, technically competent review of building performance. Periodic reports on construction types, made available to practicing consultants, would constitute invaluable guides. Such reports might finally remove questions of wall construction, flashing details, performance of exposed concrete, etc., from the area of ineffectual debate to a rational design based on proven performance and contribute to the goal of more and better public housing.

DAVID BLOOM
Consulting Structural Engineer
Philadelphia, Pa.

Tail for Tunnel Shield

Sir—The article, "Liner Rings of Concrete Wedges" (ENR May 8, p. 62), shows an interesting improvement in the shield method of tunneling, developed while driving a water tunnel under the Thames River in London.

But in the accompanying illustrations of the shield, it is seen that the precast concrete lining blocks were placed against the exposed ground material instead of being installed, as is more usual, under the protection of a skintail plate on the shield, which serves as a temporary support for the exposed roof of the tunnel. The advantage of placing the blocks tightly against the exposed material, as on the London job, is obvious. However, the possibility of the soft material caving in should be carefully considered.

ANATOL A. EREMIN
California Division of Highways
Sacramento, Calif.

CALENDAR

World Power Conference, Canadian sectional meetings, Queen Elizabeth Hotel, Montreal, Sept. 7-11.

International Commission on Large Dams, Sixth International Congress, Statler Hotel, New York City, Sept. 15-19.

New England Water Works Association, annual meeting, Poland Springs House, Poland Springs, Me., Sept. 14-17.

Building Research Institute, conference on installation and maintenance of resilient smooth surface flooring, Sheraton-Park Hotel, Washington, D. C., Sept. 17-18.

Producers' Council, Inc., 37th annual meeting and chapter presidents' conference, Dupont Plaza Hotel, Miami, Fla., Sept. 17-19.

Michigan Aeronautics Conference, 6th annual, sponsored by Michigan Association of Airport Managers, Mather Inn, Ishpeming, Mich., Sept. 17-19.

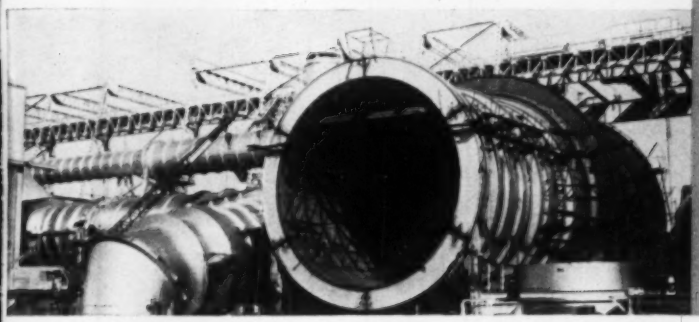
Prestressed Concrete Institute, annual meeting and convention, Edgewater Beach Hotel, Chicago, Ill., Sept. 21-25.

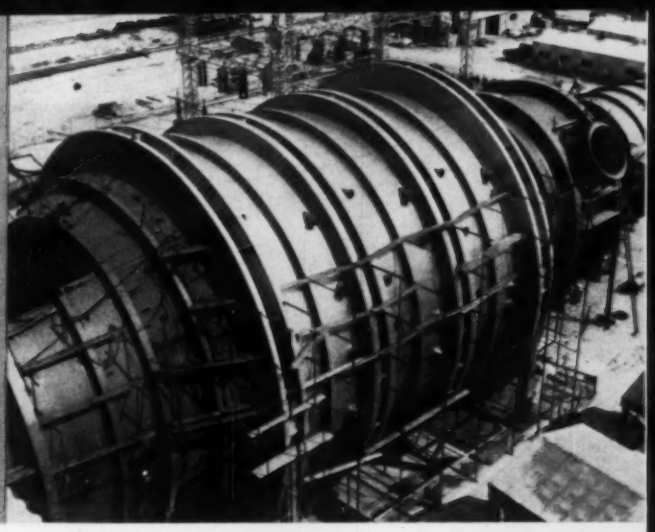
American Public Works Association, public works congress and equipment show, Municipal Auditorium and Hotel Muehlebach, Kansas City, Mo., Sept. 28-Oct. 1.

Federation of Sewage and Industrial Wastes Associations, annual meeting, Sheraton-Cadillac Hotel, Detroit, Mich., October 6-9.

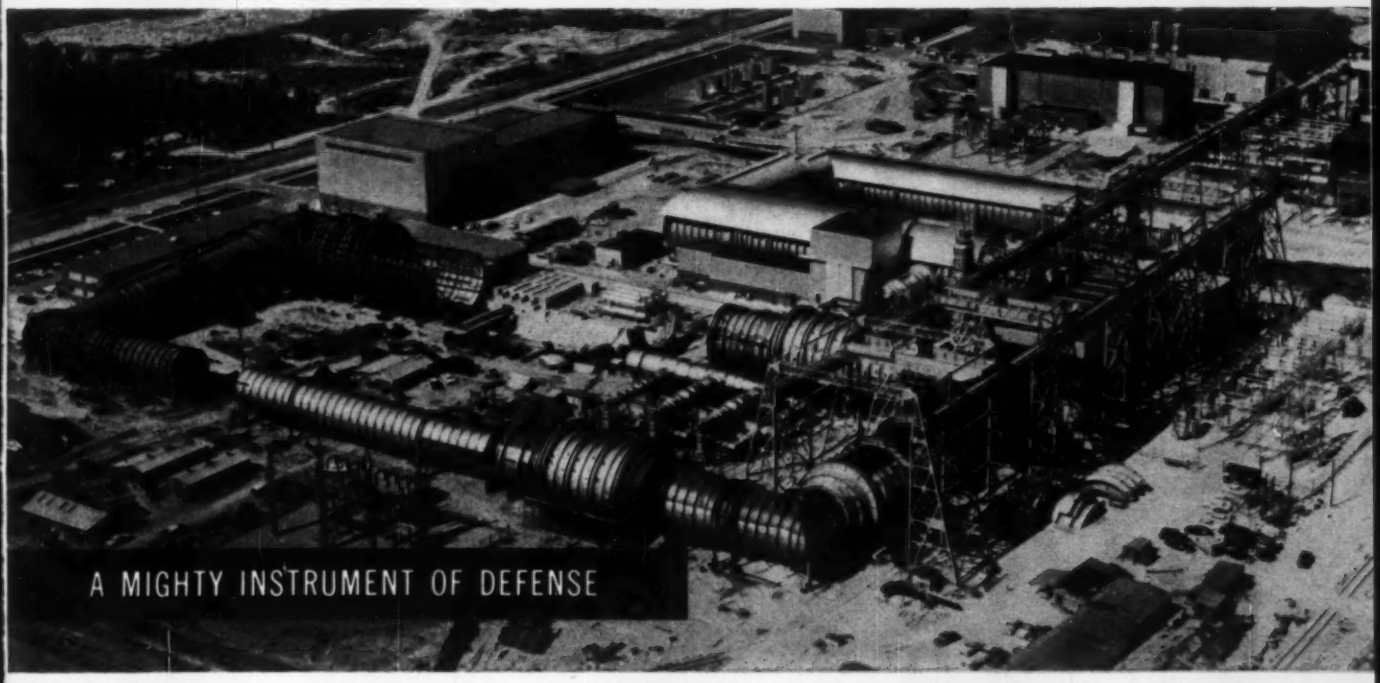
One of the tremendous coolers (right) required in the Supersonic circuit—55′ in diameter.

Transonic return duct No. 2 (below), with compressor and motor area under craneway in background.





Steel Platework by Pittsburgh-Des Moines



The Propulsion Wind Tunnel Facility at Tullahoma, Tennessee

The two largest wind tunnels of their speed in the country are shown built and under construction by PDM in the picture above. The Transonic Tunnel, now in operation, and the Mach 5 Supersonic Tunnel going up beside it each have interchangeable test sections 16′ x 16′ x 40′ long—a measure of the great size of this massive project. The size and complexity of the work are in turn a measure of Pittsburgh-Des Moines' ability to meet dependably your most exacting platework requirements. Write us for engineering consultations and preliminary estimates on your forthcoming projects.

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3 LIDGERWOOD high speed electric Cableways . . .

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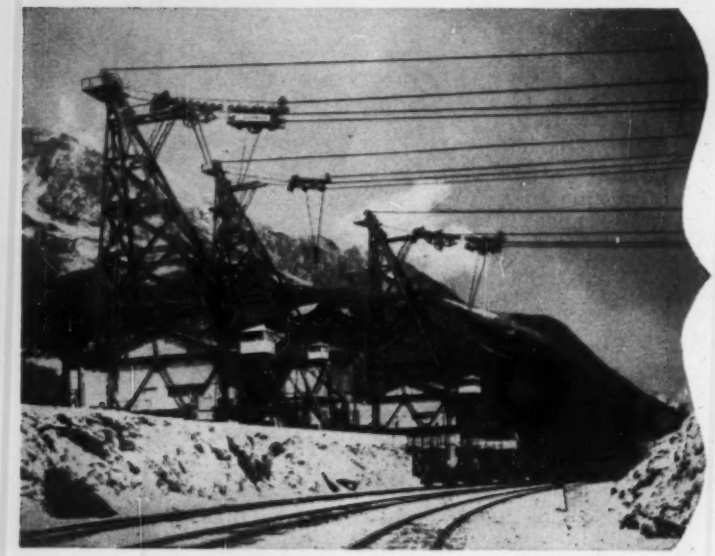

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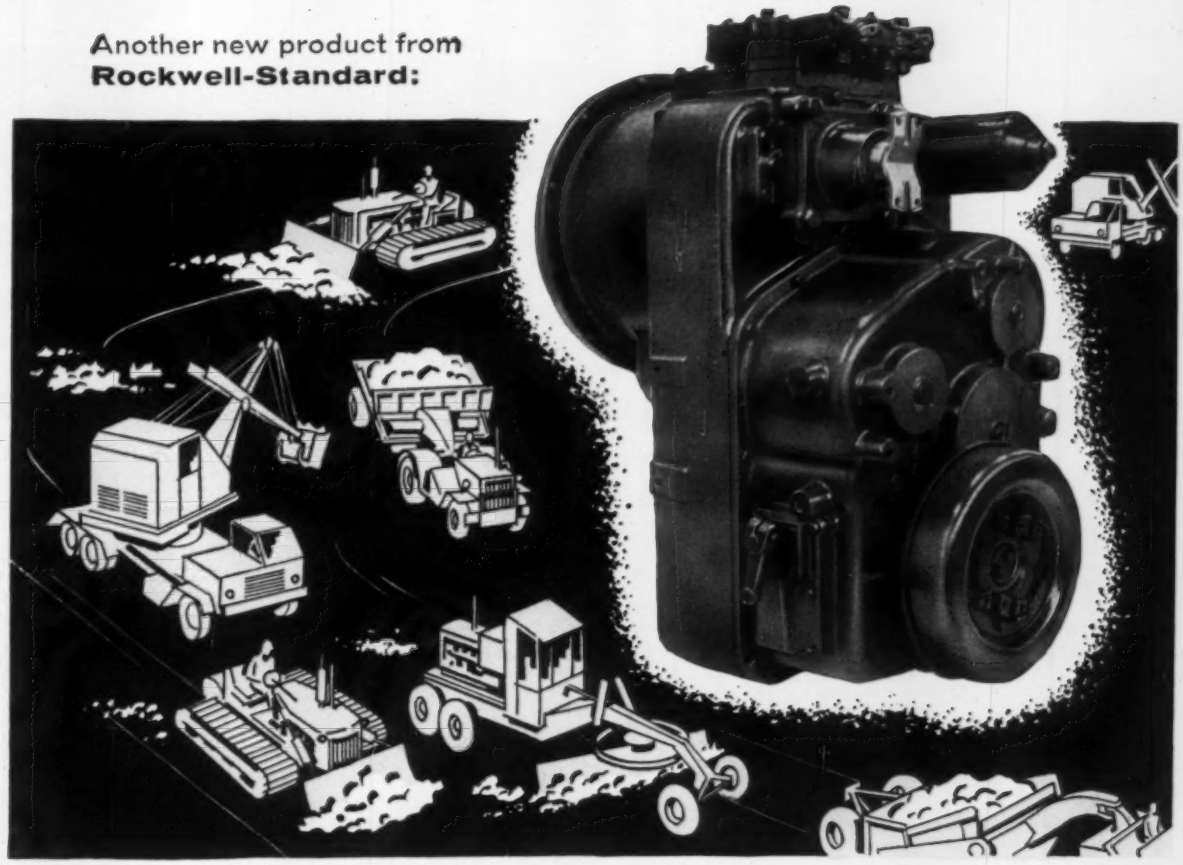

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The Transmission and Axle Division of Rockwell-Standard specializes in drive components only, and *does not compete with manufacturers of end products.* Take advantage of 50 years' experience in the manufacturing of power transmission components, specify Rockwell-Standard.

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ENGINEERING NEWS-RECORD

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THE CONSTRUCTION WEEK

837 DAYS: FAIR EXTENSION?—Merritt-Chapman & Scott Corp., New York City, and Savin Corp., Boston, contractors on Seattle City Light's Gorge High Dam, have drawn an unfavorable reaction to their request for 837 day contract extension. The project was scheduled as a four year job to be finished next February. Friction is not new on this ice barrier scheme to reduce water flow into the dam foundation excavation (ENR Mar. 7, 1957, p. 28). The stakes involved are clear cut: City Light has already committed the 50,000 kw expected from the project while the contractor is facing a $4,000 a day penalty clause.

WANTED: $30,000 MAN—The San Francisco Bay Area Rapid Transit District is on a nationwide hunt for a chief engineer. Salary: $20,000 to $30,000. The man chosen will have charge of plans for a regional rapid transit system and a $716 million, 123 mile rail network, involving subway, underwater tube and elevated construction. Most important qualification: "Imagination and broad vision . . . (of the type) that designed and built the Golden Gate and San Francisco-Oakland Bay Bridges," says District General Manager John M. Peirce (628 Flood Building, San Francisco).

NEW PAVING RECORD?—A crew has laid down 6,020 lin ft of 9 in. concrete pavement 24 ft wide in 12½ hours. This is offered as the new record, upsetting what has been called the old record, 5,787 ft in a comparable period. The feat was performed by the Denton Construction Co., of Detroit, on a nine mile section of new U.S. 23 in Michigan. Can anyone top it?

WHY?—This year, construction equipment firms will spend 15% less than in 1957 on research and development, American Management Association reports. Average R&D budget for all U.S. industry is 4% above 1957.

STRAW IN THE WIND—A tightening money market has resulted in the indefinite postponement of a $10 million bond sale by the Bergen County, N. J., Sewer Authority. It now plans to get one-year bank loans to pay for construction of Hackensack River sewer project.

NEW GOLD COAST STUDY—Prospects for a giant hydro electric and aluminum development on Ghana's Volta River have revived. A team from Kaiser Engineers left for the new African republic (formerly the Gold Coast) to start an economic and engineering feasibility study of the project. Nothing apparently has come of a British-Canadian investigation several years ago of hydro and aluminum possibilities on the stream.

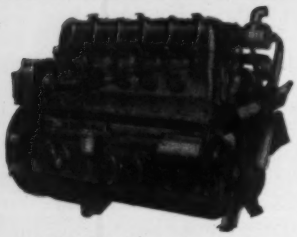
"Power to improve performance and cut fuel costs in half"

Mr. Harry Wagner of Wagner Crane Service, Bronx, N.Y., says, "This is our first experience with diesel power on our cranes. And we are very enthusiastic about our 45-ton P&H 575 Crane powered with two 6-cyl. P&H Diesels.

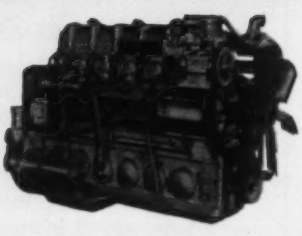
- **"P&H Diesels are more powerful than gas engines. They never stall. Even on an idle engine you can pick up a heavy load.**
- **"They cut fuel costs in half! It takes only $15 to $20 of diesel fuel a week to operate this 45-ton rig.**
- **"Morning starts in cold weather are no problem with P&H Diesels. When it comes to starting, they kick right over.**
- **"P&H Diesels are easy to take care of—all fittings are easy to get at—and all wearing parts are interchangeable."**

Until development of the P&H Diesel, owners had to be satisfied with diesels which did not fully utilize all the potentials of truck cranes that have to idle hours on end. But P&H has changed this situation. Now, when a truck crane picks up a heavy load the P&H Diesel responds instantly —without fouling.

For all your construction equipment, specify the one diesel with all the features that deliver the best in performance and operating economy —P&H Diesel! Write Dept. 415A, P&H Diesel Engine Division, Crystal Lake, Illinois.



6-Cyl. P&H Industrial Engine for "upper"—205 HP.



6-Cyl. P&H Automotive Engine for "lower"—280 HP.

P&H DIESELS

Fastest Growing Name in Diesel Power

WASHINGTON OBSERVER

- Air Force tests runway pavements
- Military construction may be cut
- Relief bill veto won't hurt

● **Tests are under way this week on a strip of asphaltic concrete runway designed by the Army Engineers for the Air Force.** The purpose of the tests: To prove the material will stand up under the heaviest of heavy jet bomber loads, as the Army Engineers claim.

The test program is the latest round in the running fight between portland cement concrete and asphaltic concrete for Air Force base runways. Air Force officials claim portland cement is absolutely necessary for their heavily trafficed runways and they prefer it for most other uses. But asphalt interests—backed by congressmen interested in economy—have been arguing for years to establish that, for most areas, their material is the equal of its competitor, and usually less expensive.

The latest Air Force ruling prescribes portland cement concrete exclusively for heavy runways and taxiways. But congressmen got a promise from the Air Force to give the Army Engineers a chance to show that an asphalt design can stand up under heavy loads.

The test strip at Columbus, Miss., Air Force Base, is being given 5,000 simulated B-52 round-trips. This amounts to 33 tons per tire, or more than 260 psi under the tires.

Test will be complete within 30 days if the weather stays fair.

—

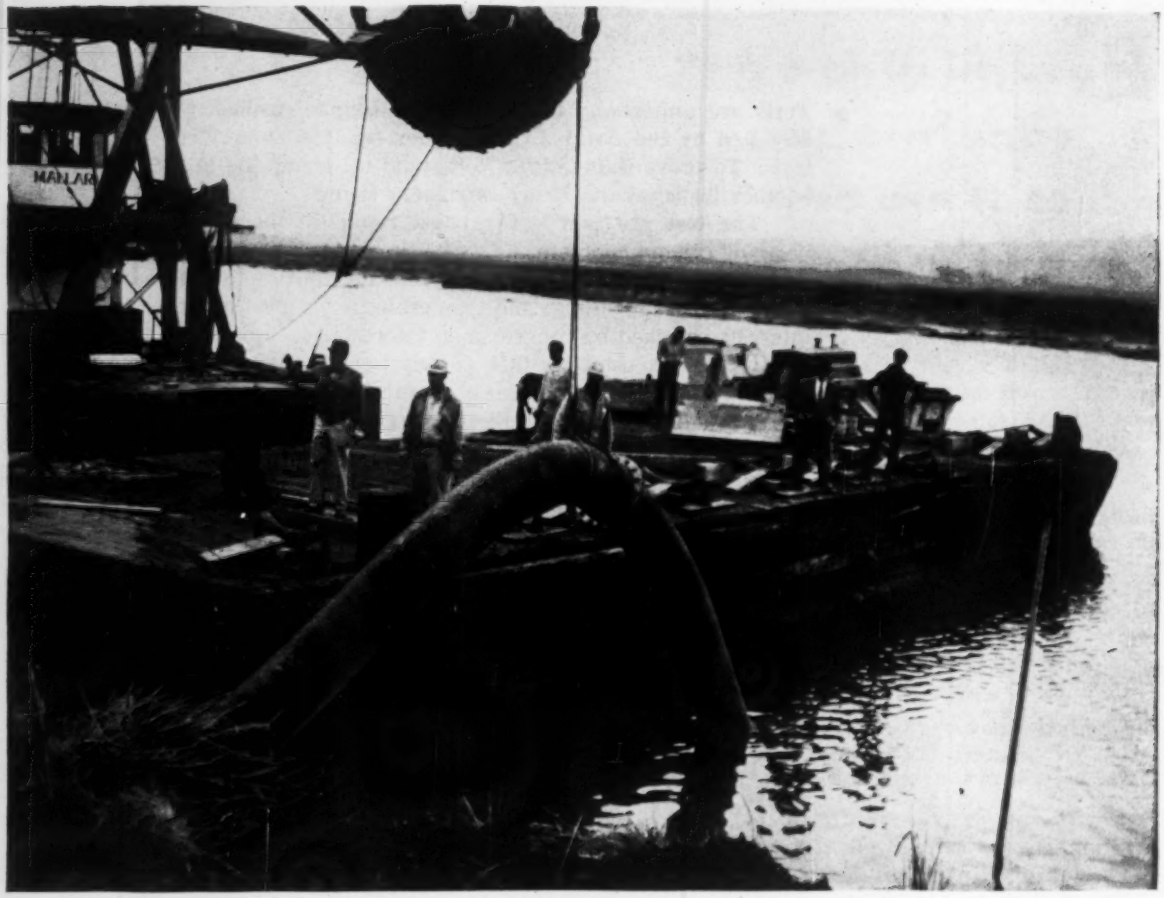
● **Top Pentagon officials are taking up their emphasis on budget-cutting about where they left off a year ago.** It all stems from changes in the basic political situation in three critical areas: (1) The Sputnik crisis is over, with public excitement about petered out, (2) the recession is considered over, politically—note the latest survey on business plans to spend for plant and equipment (page 166) and (3) the threat of renewed inflation has become the Administration's most-feared political issue. Hence, President Eisenhower and his top advisers are going all-out to cut and trim all except the most necessary spending—particularly in the Pentagon, where more than half the taxpayer's dollars are spent.

These officials are sharply eying the $1.7 billion that the services plan to spend for construction—the $1.35 billion that Congress voted, bolstered by $400 million of carry-over funds from last year. Congress cut the Administration requests drastically, mostly on what it called fringes and frills. Now the top brass—with enhanced power and prestige from the reorganized Department of Defense—are casting about for places to trim. They know construction spending this year is planned at $200 million more than last year. They think they can find fat—despite what the services might say.

—

● **President Eisenhower's veto of the so-called depressed areas bill may hurt some GOP candidates this fall, but won't make much difference to construction.** The President noted that actually he wasn't keeping any material federal aid from any community, since the measure made no provision for any money to finance the things it was supposed to do.

US RUBBER PILOT PIPE



UNDERWATER, UNDERGROUND—
this hose loves its salt diet

A large western salt company,* expanding its operations, faced an unusual problem recently: How to economically and efficiently move brine solution across the 600-ft. wide Napa River.

So they turned to 16" U.S. Rubber Pilot® Pipe.

Metal pipe could not be used because it would corrode quickly and because it lacked flexibility. But corrosion-resistant, flexible rubber Pilot Pipe has no trouble withstanding the salt water that has acid content with a PH ranging from 2.8 to 3.5. Moreover, it is flexible enough to follow the contour of the river bottom on which it lies and to handle any shifting due to river currents. Its sturdy cover is unaffected by both river silt and exposure to weathering (where it comes out of the water on either side of the river).

You'll find U.S. Pilot Pipe at work in a wide range of industries, in a wide variety of demanding uses. It's available to you at your "U.S." Distributor.

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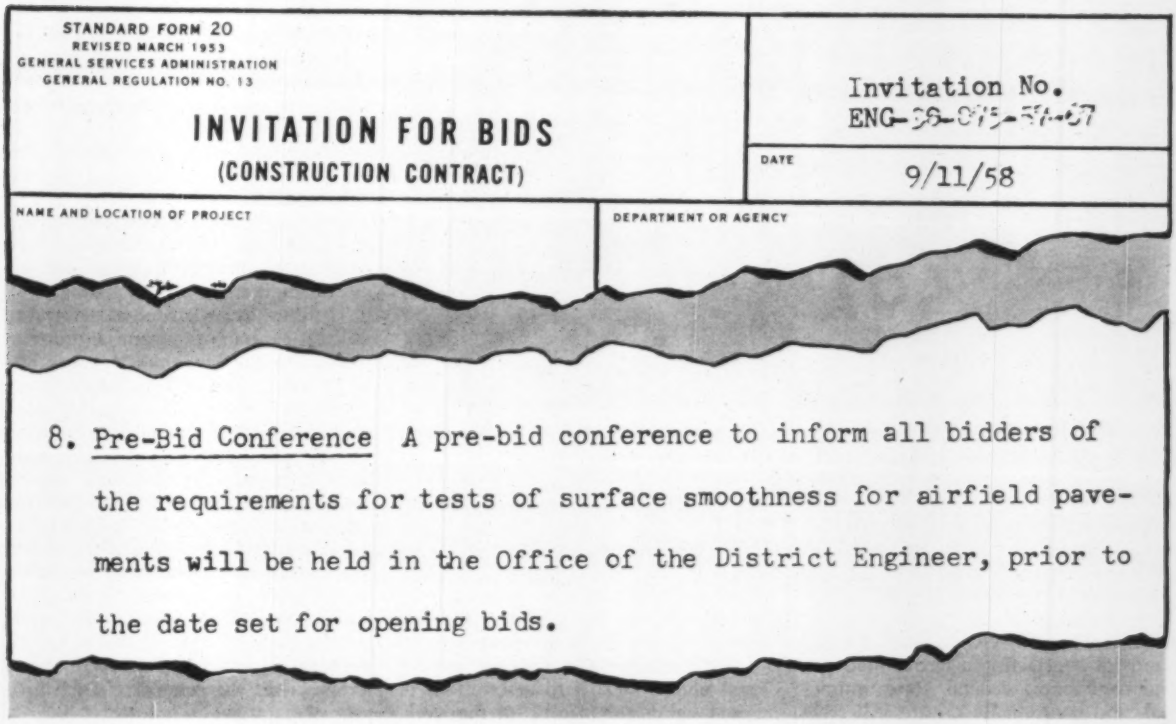


STANDARD FORM 20
REVISED MARCH 1953
GENERAL SERVICES ADMINISTRATION
GENERAL REGULATION NO. 13

INVITATION FOR BIDS
(CONSTRUCTION CONTRACT)

Invitation No.
ENG-[illegible]

DATE 9/11/58

NAME AND LOCATION OF PROJECT

DEPARTMENT OR AGENCY

8. Pre-Bid Conference A pre-bid conference to inform all bidders of the requirements for tests of surface smoothness for airfield pavements will be held in the Office of the District Engineer, prior to the date set for opening bids.

Do Pre-bid Conferences Really Pay Off?

Did the hundreds of contractors who bid on hundreds of millions of dollars worth of construction this week attend pre-bid conferences before estimating?

Some did; some didn't. And many more didn't than did.

Do owners' engineers and contractors find pre-bid conferences worthwhile?

Some do; some don't. Owners' engineers who conduct them repeatedly obviously consider them worth the effort. And contractors who attend do so with some gain in mind, else they need not attend at all.

Despite differences of practice and opinion, pre-bid conferences have become a part of construction's contracting procedure. Although far from universally accepted, they are quite generally thought to be worthwhile if the job to be bid is complex. They are just as generally considered a waste of time if plans, specifications and the conditions under which work is to be done are all familiar to the prospective bidders.

Complexity of the work is the key to need for the pre-bid conference. Complicating factors, not fully detailed in plans and specifications, can be explained in conference with prospective bidders. Bidders then can estimate more surely—and maybe, more sharply.

It's hard to find firm proof that pre-bid conferences pay off in lower bids. But they can benefit indirectly in many additional ways, all of which could mean dollars and cents savings.

Sometimes the real purpose of the conference is to drum up contractor interest and produce more bidders on a job. Sometimes the conference is intended to get sound contractor opinions of the schedule or the method proposed by the owner's engineers. Often the conference winds up as a critique of the design and specifications, resulting in changes and the issuing of addenda—occasionally delaying bid openings.

It is not uncommon for the contractors' representatives to point out ambiguities, discrepancies or impracticalities in the plans. Nor is it rare for contractors to come away with confidence or added information they needed on allowable methods, purposely not spelled out by the engineers in the specs for fear of stifling contractor ingenuity.

• **Some question value**—Those who don't hold pre-bid conferences for prospective bidders see no advantage in them. Here are some typical comments:

"All the information is contained in the specification. . . it would be difficult to refute a bidder's claim that he was misled at the conference. . . Legally, it's safer to put everything in the specs. . . . Contractors are reluctant to discuss their individual problems and method of resolving them in front of a group. . . Not all qualified bidders show up; they don't want to give out any of their ideas, or in some cases they don't even want to identify themselves as interested in the job prior to the bidding. . . Often, the eventual low bidder is among the missing."

• **Depends on job**—It all gets back to this: the pre-bid conference pays off most when unfamiliarities—complexities or novelties—need discussion.

Size of the job is not necessarily a factor. A municipal building agency calls a conference of bidders on every contract expected to be $500,000 or more. A local contracting officer for a federal agency has called in prospective

. . . Pre-bid conferences—How they're run, who goes, questions they answer

THIS PRE-BID CONFERENCE for prospective bidders on a contract for the Dalles Dam featured study of a hydraulic model for information on closure methods.

bidders to discuss a $4,000 job on vital utilities, which could be shut down only for a limited time. Yet an extensive, multi-million dollar earthfill contract might be bid without discussion because nothing complex is foreseen.

A check by ENR discloses that all kinds of contracting agencies hold pre-bid conferences—federal, state, municipal, and occasionally private. All types of jobs are subjects of such conferences.

• **Corps long a proponent**—Perhaps the biggest and staunchest supporter of pre-bid conferences is the Corps of Engineers. (Its sometime partner in river development, the Bureau of Reclamation, on the other hand, does not so generally subscribe to the conference advantages.) In Missouri River Basin work, in particular, the Corps has considered conferences with prospective bidders so worthwhile that they have become standard operating procedure on complicated and important jobs. About the only possible cause for discontinuance would be lack of contractor interest.

Contractor interest may have waned somewhat over the years as the novelty wore off, but it still prevails. The Omaha District still recalls its first pre-bid conference in 1946, which drew 80 representatives of the construction industry to discuss Garrison Dam with Col. W. W. Wanamaker (then the district engineer) and his staff. It was a three-day junket held in advance of advertising for bids, and it was hailed by ENR's Vincent B. Smith at the time as setting "a most promising precedent" (ENR Nov. 14, 1946, p. 89).

The Corps continues to hold conferences on every big, new project—or new phase of a going job—with which contractors might not be fully familiar. Just this year, a session on an Oahe Dam contract took nearly a whole day three weeks before receipt of bids. Sixteen representatives of nine big contractors—plus representatives of five construction equipment manufacturers—asked questions, saw a model, studied aerial photos and heard descriptions of several significant features of the work. Questions and answers dealt with tricky construction operations such as pressure grouting, shaft sinking and closure scheduling—plus the operation and storage of construction equipment and materials.

• **Saves phone calls**—Legally established competitive bidding procedures demand that any information for bidders must go to every prospective bidder. As contractors who have taken out plans and specs ask questions of engineers or architects, these questions must be recorded, and the answers must go in writing as addenda to all who have interest in the bidding. The pre-bid conference is a device for answering all such questions at once; a written transcript of the complete conference goes to all prospective bidders—whether they attended the conference or not.

So that both owner and contractors will get maximum advantage from the pre-bid conference, it is generally held about half-way between the invitation to bid and bid opening (which may be a 30 to 60 day period). This timing is intended to give the contractors opportunity to study the plans and specs and find the questions they need to ask, and yet give the owner's engineers time to issue the results of the conference—addenda or revisions—far enough in advance of the bidding date.

• **The questions asked**—There are no limitations put on the type of question a contractor's representative may ask at the conference, yet most have to do with misunderstanding of the bidding documents.

Labor is not normally a question for discussion since this is primarily the contractor's problem. However, remote construction jobs may require that the owner's engineers explain the facilities for transporting workers, housing and feeding them at the site.

Safety precautions are not a general topic for discussion; these are more likely to be discussed only with the successful bidder, after the opening.

Utilities the owner might make available for contractor use can be described and discussed. The removal or handling of utilities during construction are more apt to be a point of discussion solely between contractor and utility owner.

Subcontracts are not usually a point at issue in pre-bid conferences. Yet, on building work, subcontractors are often present. Where mechanical and electrical contracts are made directly with the owner, those interested in bidding are certainly represented. Rarely (and again, on building work) the pre-bid conference might be occasion for the owner to approve lists of subcontractors proposed by the generals.

• **Sometimes in the field**—Pre-bid discussions are not always conference room sessions. There are some owners' engineers who think the site visit is the only fully worthwhile way to meet with prospective bidders.

Among private owners strong for this method is Pacific Gas & Electric in San Francisco.

On large construction jobs, with the invitation to bid, PG&E engineers invite the bidders to meet them in the field and go over the site. The trip is set for some day after they've received the plans and specifications and have had a chance to look at them.

Generally PG&E will arrange for a whole group to go to the site, but if they prefer, contractors can arrange to go into the field individually when the engineers are there. Such meetings are conducted by field engineers. PG&E likes to have contractors see the site, see the lay of the land, discuss such questions as where housing facilities will go, where trailer parks might be set up for workers, and what utilities—such as water and power—PG&E will bring in for workers.

At the field conference, prospective bidders can bring up anything that is not written into the specifications: where they might get aggregate, where roads will go. Recommendations made are usually followed, but not necessarily.

• **Typical question**—Here's an example of the type of question a pre-bid conference might answer. It is cited by a municipal engineer concerned with water and sewerage projects:

An excavation job appears to a contractor to call for dewatering. The owner has information on the extent to which groundwater can be drawn down without causing settlement of the subsoil that might endanger surrounding structures. The limit to which dewatering may go determines the contractor's dewatering method.

He leaves the conference better able to estimate the job. The owner can at least hope this will mean a lower bid on the work.

Some other typical areas of questions cited by conference users include: protection of surrounding structures; necessary site drainage; permissible use of space for stored materials.

Other specifics of pre-bid conference subject matter include the rare USBR session to which turbine manufacturers might be called to discuss what specifications and delivery dates they could meet; the Illinois Toll Highway Commission's meetings with contractors to distinguish the differences in its specs from the more familiar state highway department standards.

Availability of right-of-way and locations of borrow material are generally two key questions at the highway job's pre-bid conference. (The American Association of State Highway Officials says practically all states hold them—but only on occasional, complex jobs.)

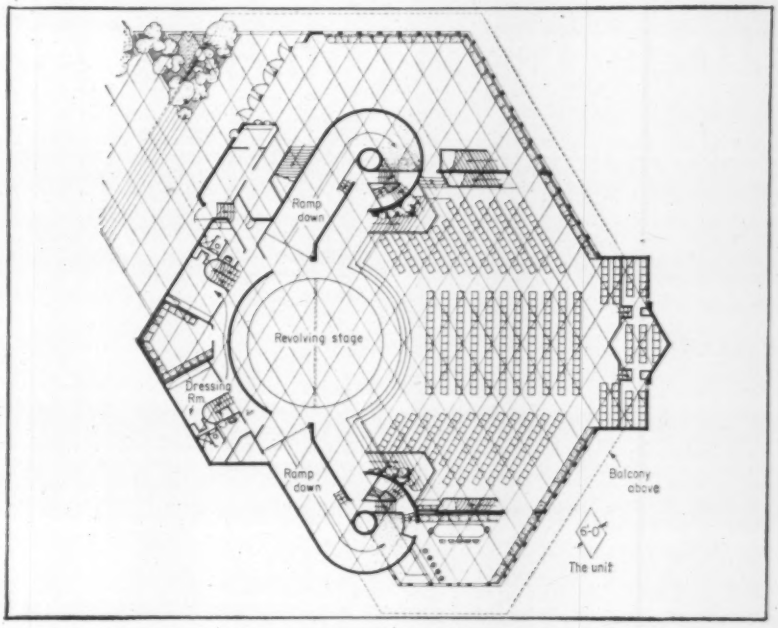
• **Who attends**—Contractors are more often than not represented by one or more men intimately concerned with estimating the job. Top management may attend if the job is a big one.

For the owner, the contracting officer may be backed up by a whole squad of designers, specification writers and experts on soils, concrete and other specialties, depending on the type of work.

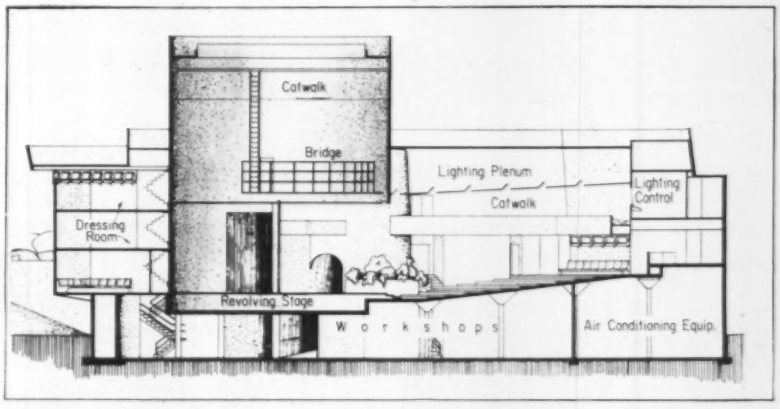
All participants are assembled for a somewhat formal session where questions and answers are the heart of matter. Some agencies make more of a show of it than others, with elaborately prepared presentations, visual aids, even movies.

Preparation of the pre-bid conference does take time and effort. And attendance itself can tie up several key people on the engineer's or architect's staff for considerable time.

Those who continue to spend the time and effort do so mostly on particular jobs where they are sure the expenditure will pay off. All point out, however, that the conference should not take the place of preparation of clearest possible plans and specifications in the first place.



Novel theater is irregularly shaped, has round stage . . .



Auditorium spanned by trusses is clear of columns, but . . .

What Holds Up the Proscenium?

It takes a bit of study to figure out how Frank Lloyd Wright intends to support the wall above the front of the stage in the theater he designed for the Dallas Theatre Center, now under construction. It has no conventional proscenium arch.

The structure will be used as a repertory theater and school of drama. It has a revolving stage and two side stages. Viewed from the 421-seat auditorium, a concrete wall will seem to hang over the front of the stage without apparent support.

Mr. Wright designed the wall as a curved cantilever beam. He surrounds the circular stage with a cylindrical reinforced concrete wall 40 ft in diameter and 8 in. thick, extending up to the roof. Portions of the cylinder are omitted, of course, at the front of the stage and where openings are needed at the sides. A proscenium arch is not needed because the part of the cylinder above the stage is designed to act as a cantilever.

The building's irregular shape results from Mr. Wright's choice of an unusual module, a 6 ft wide rhombus, instead of a conventional rectangle.

The $500,000 building covers 11,000 sq ft of ground and provides a total floor area of 30,000 sq ft on three levels.

Henry C. Beck & Co., general contractor began construction September 1. Completion is planned for next July.

New PCA Laboratory is a . . .

Huge Testing Machine for Concrete

For sheer strength of testing apparatus, versatility and flexibility, the Portland Cement Association's new $1 million structural laboratory is unequaled in the field of concrete research and development. The lab flexed its muscles last week in a girder-breaking demonstration.

The reinforced concrete building and its equipment is a unique facility that may have a revolutionary effect on future structural testing laboratories, a company spokesman says. The laboratory is a giant testing machine in itself, capable of exerting test forces greater than 10 million lb.

• **Floor used in testing**—Indicative of the laboratory's capabilities is the 56 x 120 ft floor—designed to act as a hollow, concrete box girder longitudinally and a Vierendeel truss transversely. Overall depth of this giant girder is 12 ft, made up of a 24 in. thick top slab at ground level and an 18 in. thick reinforced concrete basement floor slab joined together by five 8½ ft high, heavily reinforced, vertical concrete web. Interior webs are 18 in. thick and exterior webs are 24 in.

The first floor slab is pierced by 690 holes, 2½ in. in diameter and spaced 3 ft c-c each way. These holes will be used for anchors to apply loads and secure test specimens in place. All test loads will be produced by jacks.

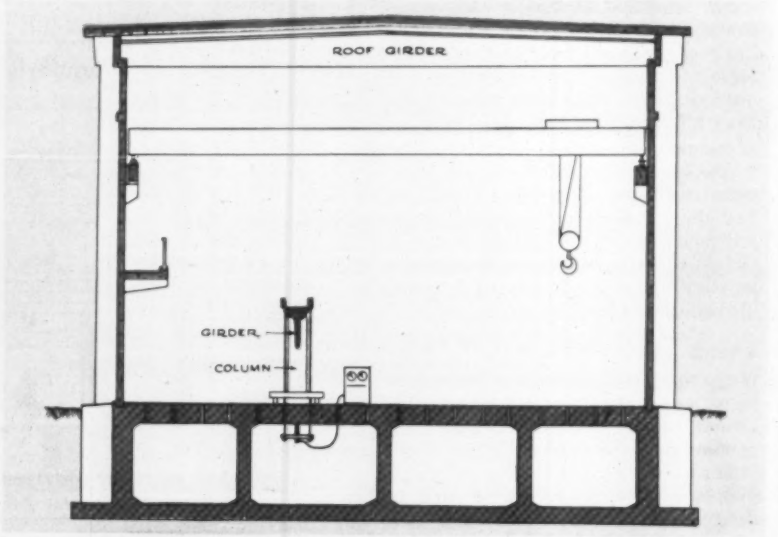
One end of the building holds a 22 ft long bay with three stories of offices and shops. The rest of the building is one large room, 40 ft high, with a balcony to accommodate visitors.

The entire testing and casting area inside the building is served by a 20 ton crane and is air conditioned to 70 F and 50% relative humidity.

• **Precast construction**—As expected, precast concrete played an important role in construction of the laboratory. The building above the first floor was assembled with precast concrete elements. These components were designed by the ultimate-strength method and are made of concrete with a minimum compressive strength of 5,000 psi at 28 days and alloy-steel reinforcing with an ultimate strength of 70,000 psi.

Slender 58 ft girders carry the roof. They are supported on precast columns. Exterior walls are precast panels formed with newly developed plastic and rubber form liners to obtain decorative textures and patterns. The panels are made of light weight concrete (expanded-shale aggregate) with a 28-day strength of 4,000 psi.

RESEARCH CENTER owned by Portland Cement Association gets a new 180 x 60 ft lab. The floor will have to carry several million pounds of pressure in testing.



CELLULAR CONCRETE FLOOR was used, with precast framing and walls, in the new lab. The floor will have to carry several million pounds of pressure in testing.

• **Jacks will apply loads**—The testing machine can exert tremendous forces on girders, beams and other specimens undergoing tests. At present the laboratory has hydraulic jacks capable of a combined force of about 4 million lb. Additional jacks will be obtained as needed for future experiments.

Each jack is calibrated so that loads on a specimen can be measured by sensitive oil-pressure meters. Reactions moments, forces and shears are measured with electronic load cells designed and built by the laboratory's personnel. Strains are measured with mechanical and electrical strain gages and the readings are recorded by automatic recorders or by hand-operated strain indicators.

Deflections of specimens can be measured by dial gages or high precision leveling, accurate to 0.002 in. Space movements, such as encountered in tests on floor slabs or roof shells, are measured by first-order triangulation accurate to 0.01 in.

One unusual piece of testing equipment in the laboratory is a Swiss-made set of dynamic testing jacks. Four hydraulic jacks, each capable of applying loads up to 22,000 lb at a rate of 250 or 500 applications per minute, are driven by a pulsator. This machine is now being used in repeated loading tests of prestressed bridge members. The dynamic jacks are supported by reinforced concrete frames fastened to the test floor by tensioned bolts.

• **The lab's function**—Initial investigations in the laboratory reflect the most pressing needs of concrete design and construction. These include connections between precast structural concrete members, and full-size continuous floor systems.

Another important study deals with methods of achieving continuity between prestressed members and with repeated load tests of prestressed girders. High-strength reinforcement without prestressing also will be researched to develop more economical concrete reinforcement and better use of structural concrete. One long-range program deals with the design of shell roofs.

• **Other design details**—The structural laboratory contains 18 precast columns 2 ft square and 43 ft long, arranged to form nine bents 22 ft c-c. They extend nearly 5 ft into heavily reinforced sockets in the foundation, and thus are cantilevered from the test floor.

The roof girders fit into slots at the top of the columns much like the old mortise-and-tenon joint. These 58 ft span roof girders were not designed as prestressed members, although they could have been. They were designed for a maximum stress in the reinforcement at ultimate load of 70,000 psi—equal to the minimum yield strength of the alloy steel used. Maximum allowable unit shearing stress with stirrup reinforcement was increased from 240 to 300 psi. The designers waived the provision that 60 deg inclined stirrups must be welded or otherwise rigidly attached to the longitudinal steel. A more conservative stirrup design procedure was used, and face bars were provided to control cracking in the girder web.

To substantiate these departures from the ACI Code, two 0.38 scale girders were made and tested before final design was established.

The girders are 4 ft deep at midspan and 3 ft at supports. The top flange is 24 in. wide and averages 7 in. thick. The web is 7 in. wide at the bottom, thickening to 9 in. at the flanges. Tension reinforcement consists of eight No. 9 alloy steel bars at midspan, of which only three extend the full length of the girder.

The roof deck is composed of hollow, precast concrete units spanning 20 ft between girders.

The laboratory is supervised by Eivind Hognestad, under Douglas McHenry, director of development. The lab is staffed by 10 engineers and 10 technicians, and draws on the services of the PCA Research and Development Division.

Dunlap and Esgar, Chicago architects, designed the laboratory, with the cooperation of the PCA staff. George A. Fuller Co. was the general contractor.

State Freeway Net: $10.5 Billion

The California Division of Highways last week announced a plan for development of the state freeway system that calls for a 12,250 mile freeway network to be completed by 1980 at a cost of $10.5 billion.

The plan was prepared for the state legislature, which called for a study of future freeway development so that state, county and city transportation plans and fiscal arrangements could be worked out and coordinated.

Not all of the suggested mileage will involve new construction. The plan includes 1,900 miles of already completed freeways and 400 miles of freeways currently under construction. However, it is the first time that a plan for an integrated system has ever been presented and it does call for 9,950 miles of new roads. Furthermore, the study was not limited to state highways. It includes some 1,500 miles of freeway that is not in the existing or proposed state highway system.

A legislative committee—the Joint Interim Committee on Highway Problems—is studying the plan and has begun to hold public hearings. The first hearings were held in Los Angeles on September 4; additional meetings will take place there on September 22-23. On September 24-25 hearings will be held in San Diego and on September 26 in Fresno. The committee expects to present its recommendations to the state legislature when it reconvenes in January.

Here are the highlights of the freeway plan:

• It could be built over a 20-year period.

• It would serve every California city that is expected to have a population of at least 5,000 by 1980.

• It would not require an increase in highway user taxes.

• It would accommodate 59% of the statewide motor vehicle traffic anticipated by 1980.

• It is expected to reduce highway deaths by 60-75% on full freeways.

In selecting routes, the Division of Highways had these objectives:

• Connect major centers of population.

• Link main centers of industrial activity and natural resources with labor and material supply centers and shipping points.

• Provide access to the state's recreational areas.

• Connect county seats.

• Provide for continuity of travel into, through and around urban areas from rural freeway approaches.

• Provide needed capacity in traffic corridors.

• Accommodate large traffic movements between population and industry within urban areas.

• Connect with major highways of adjacent states.

• Provide an integrated system with a minimum of stubs or spurs.

In developing the plan, the Division of Highways asked local authorities to submit proposals. Most of them concerned roads and streets outside the state highway system. Then district engineers of the division looked over the proposals in relation to state highway routes that might qualify for freeways and turned in their own recommendation to division headquarters.

The division based its plan on an estimated California population in 1980 of 31 million—more than double the present number.

The state's two largest metropolitan centers—Los Angeles and the San Francisco Bay area—are slated for the biggest expenditures for new freeways. Under the plan Los Angeles would get $3.2 billion in new roads and the six Bay area counties would get a total of $1.6 billion.

The Division of Highways says the plan would have to be re-evaluated from time to time, since growth patterns cannot be predicted accurately.

President OK's $10 Million For Five Desalting Plants

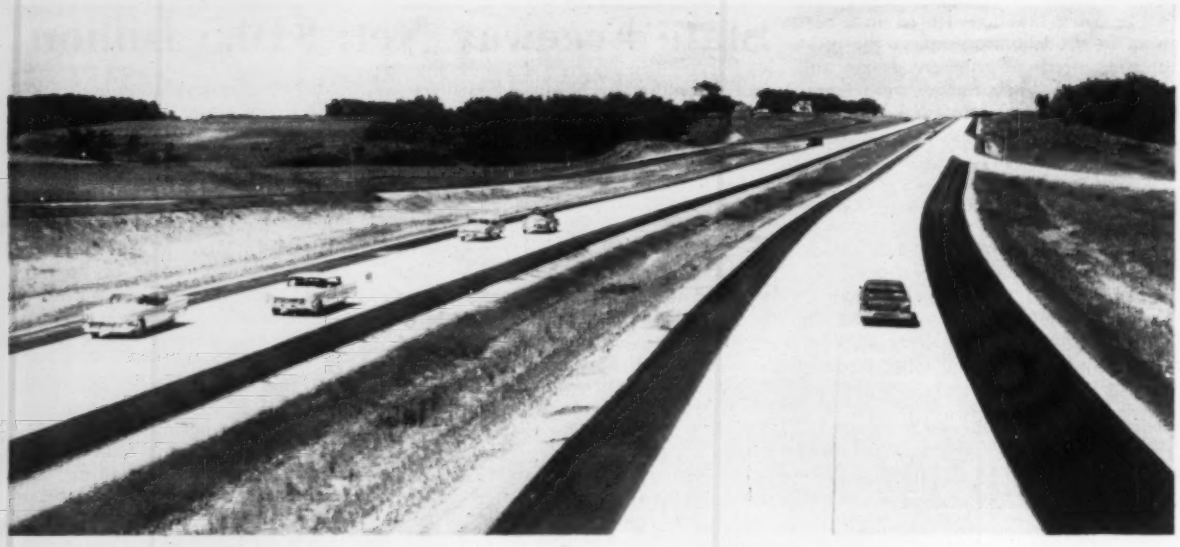
Research aimed at economic desalting of salt or brackish water got a big boost from the federal government last week. President Eisenhower signed a bill providing $10 million for construction of demonstration plants.

Purpose of the plants is to see how economically fresh water can be produced from salt through several processes and techniques.

The money hasn't yet been appropriated, but the Department of Interior's Office of Saline Water will go ahead with plans for bid invitations for the first plant. Contracts won't be signed until Congress puts up the money next year.

The new law calls for construction of at least five plants—three to convert seawater and two for inland brackish water. The Interior Department will decide within six months what the first plant will be. Decisions on the other plants will follow at three-month intervals.

The idea is to build at least one seawater plant on the East Coast, one on the West Coast and one on the Gulf Coast. Two of them would have output capacities of at least a million gallons a day. The two brackish water plants must be located in the northern plains states and the Southwest.



Two States Open Their First Interstate

Minnesotans and Wisconsinites now have evidence of interstate highway system progress that they best understand: First sections of completed road open to traffic.

Minnesota opened its first length of interstate system pavement August 21—a 8.3 mile stretch on Route 35 between Owatonna and the Twin Cities, Minneapolis-St. Paul. Wisconsin followed on September 4 with 6.3 miles on Route 94 about 20 miles west of Milwaukee.

Minnesota's road ran to $3.1 million; Wisconsin's cost $1.3 million. Both, of course, meet U. S. Bureau of Public Roads requirements for the system. They feature fully controlled access, two 24 ft wide, 9 in. thick portland cement concrete pavements separated by depressed medians and flanked by asphalt shoulders.

Right-of-way for both roads is generally 400 ft. Minnesota uses a 40 ft wide median, with 10 ft outside and 6.5 ft inside shoulders of 2 in. bituminous surfacing. Wisconsin goes to a 50 ft median, with 7 ft outside and 3 ft inside shoulders of asphaltic concrete.

Some idea of the construction involved is given by Don Larson, resident engineer for the 8.3 mile stretch of Minnesota road. Cost included $1.1 million for grading and drainage, $1.5 million for concrete paving and bituminous shoulders and $490,000 for six small bridges.

Compacting the subgrade to required density of 95% Proctor or 103 lb per cu ft involved 1,200 gradation tests of the various types of soils available, and 1,900 density tests. The project called for nearly 2 million cu yd of excavation.

The 8.3 mile section represents slightly less than 1% of Minnesota's interstate highway system to be built in the 13 year period. Wisconsin's 6.3 miles represent about 1.5%.

Here is a rundown on the two states' programs.

1. Minnesota

Minnesota's 888 mile interstate highway program is estimated at $728 million at today's prices—slightly less than $1 million a mile.

It consists essentially of three routes: east-west Route 90 extending across the southern end of the state, passing near Albert Lea and leading toward Sioux Falls, S. D., on the west, and LaCrosse, Wis., on the east; north-south Route 35 from Albert Lea through the Minneapolis-St. Paul area to Duluth; and Route 94 extending northwest from the Twin Cities to Moorhead just east of Fargo, N. D.

The Twin Cities metropolitan area will be completely surrounded by an interstate loop highway—Routes 494 and 694. Two north-south Routes 35E and 35W will cut through the two cities. A fifth route, 94, will extend south from the north leg of the loop highway to the center of Minneapolis, then eastward through St. Paul to the state line where it will connect with Wisconsin's interstate Highway 94.

• **Fiscal programs**—Minnesota's interstate highway program for the current fiscal year will total about $50 million—an increase of about $34 million over the interstate highway construction program during fiscal 1958. About $23 million worth of interstate highway work will be awarded at six lettings scheduled for the last half of 1958.

By June 30, 1959, contracts totaling $29 million are expected to be awarded for the construction of 73 miles of interstate highways including 83 bridges.

For the fiscal year 1960, Minnesota is developing an interstate highway program expected to cost on the order of $50 million.

John H. Swanberg is chief highway engineer and W. S. Ekern is construction engineer.

• **Twin-Cities planning**—Although only a relatively small amount of interstate highway construction has been put under contract in the Minneapolis-St. Paul metropolitan area, considerable planning has been done and designs completed.

To speed up the program, two coordinating design committees were formed last February at the request of Minnesota's highway commissioner, L. P. Zimmerman. The chief function of the committees—composed of city, county, state and federal representatives—is the development and integration of the interstate, state, county and city highways. Their most critical concern is the interstate system and its relationship to the other highways. Each committee serves one city. Mr. Swanberg is chairman of both.

Reporting to each of the coordinating committees are six subcommittees: design, utilities, transportation and traffic, right-of-way and land use, aesthetics, and resettlement. Both subcommittees on design, utilities, right-of-way and aesthetics are chairmanned by the same engineer.

2. Wisconsin

Wisconsin's interstate highways also will cost an average of about $1 million per mile. The 452 mile system will run to $469 million, according to Wisconsin estimates.

Wisconsin has two interstate highways. Route 94 begins at the Illinois state line with a connection to the Illinois Tri-State Tollway, runs due north to Milwaukee, westerly to Madison, then angles northwest to Eau Claire and the Twin-Cities area.

Route 90 runs from Beloit, where it connects with Illinois Northwest Tollway, to a junction with Route 94 near Madison. The two routes coincide at a point near Tomah, where Route 90 branches off in a southwesterly direction to LaCrosse.

About $79 million will be spent this year on the state's interstate highway system. Of this amount, engineering and right-of-way will cost $12 million and construction, $67 million.

On September 1 this year 57 miles of interstate highways were under construction. At that time 48 miles of right-of-way were being appraised for purchasing; general routing had been approved for 154 miles of interstate highway, and route studies were in progress for the remaining 193 miles of the 452 mile system.

Up to July 1 of this year, the Wisconsin State Highway Commission had encumbered $35 million for construction, purchased $27 million of right-of-way and spent $1.6 million for surveys and plans for its interstate program.

When completed in 1959 and 1960 the 33 mile length of Wisconsin's north-south interstate Highway 94 from Milwaukee to the Illinois state line will have four parallel separated roadways. The two center ones will carry interstate traffic while the two outer roadways will serve as frontage roads for local traffic. Target date for opening to traffic the rural sections of interstate Route 94 in Milwaukee County is the fall of 1963.

Responsibility for expediting Wisconsin's interstate highway and other state highway programs is that of E. L. Roettiger, state highway engineer. S. E. Hicks is construction engineer.

Plan $19.8 Million Bridge To Link U. S. and Canada

Top Canadian and American officials have tentatively agreed to build a $19.8 million bridge at Lewiston, N. Y., over the Niagara River. It would link the New York State Thruway with the Canadian Queen Elizabeth Way. The span would be a joint venture of New York State and the Niagara Falls Bridge Commission. How it is to be financed is still undecided.

Welded Steel Frame Collapses

Just hours short of completion, an 11 story welded steel frame toppled to the ground last weekend in Toronto, Ont. No one was killed or injured.

The 1,850 ton frame was being erected for the $5 million headquarters of the Union Carbide Co. of Canada, Ltd. Damages have been estimated at $600,000.

The building was to have been 215 ft long by 65 ft wide, with a separate tower for elevators. Columns were spaced 20 ft c-c along the sides of the structure, and girders spanned the width of the building, eliminating the need for interior columns.

The accident occurred at 6:20 PM last Saturday. When workmen left for the weekend, the frame had been erected to its full height. Welding is reported to have been completed up to the ninth floor and was to have been finished Monday. The frame was cable-braced temporarily. No walls or floors are reported to have been in place.

Gusty winds are believed to have struck the frame at the time of collapse. An eyewitness says the top two stories at one corner started to fall and then the rest of the frame toppled like a deck of cards. It fell in the longitudinal direction.

Shore & Moffat was the architect. Anglin-Norcorss, Ltd., is the general contractor. Dominion Bridge Co., Ltd., fabricated and erected the structural steel and Perini, Ltd., built the substructure. All are Toronto firms.

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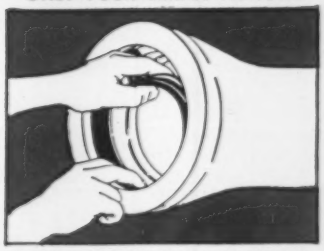
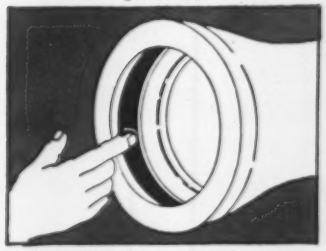
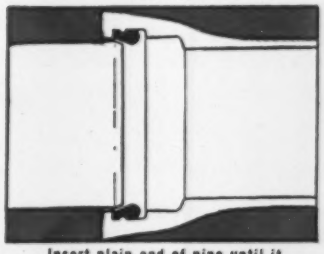


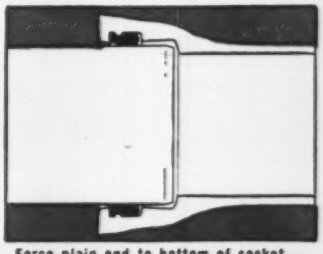
Insert gasket with groove over bead in gasket seat



Wipe a film of special lubricant over inside of gasket

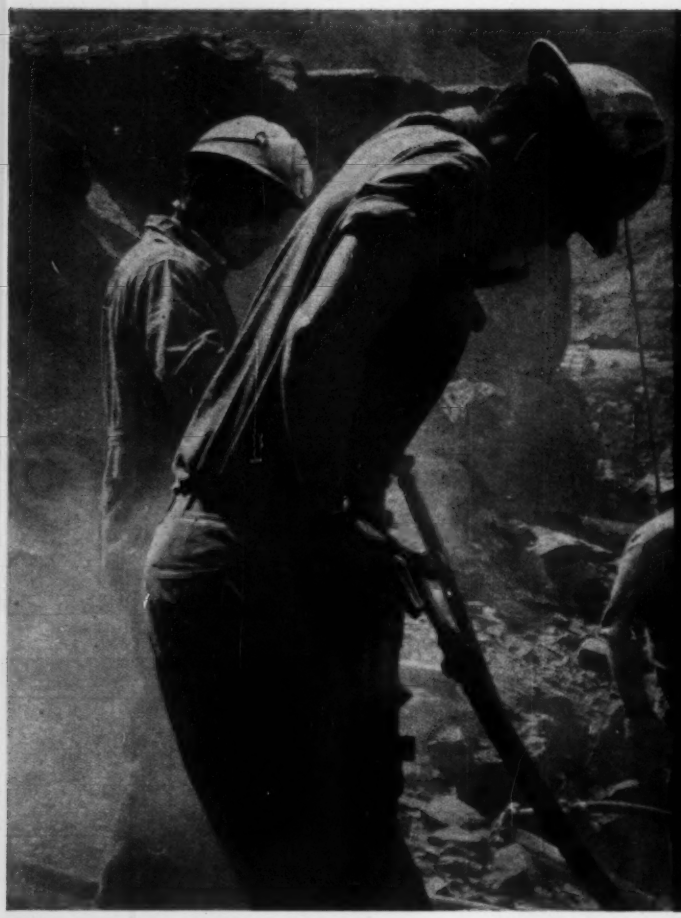


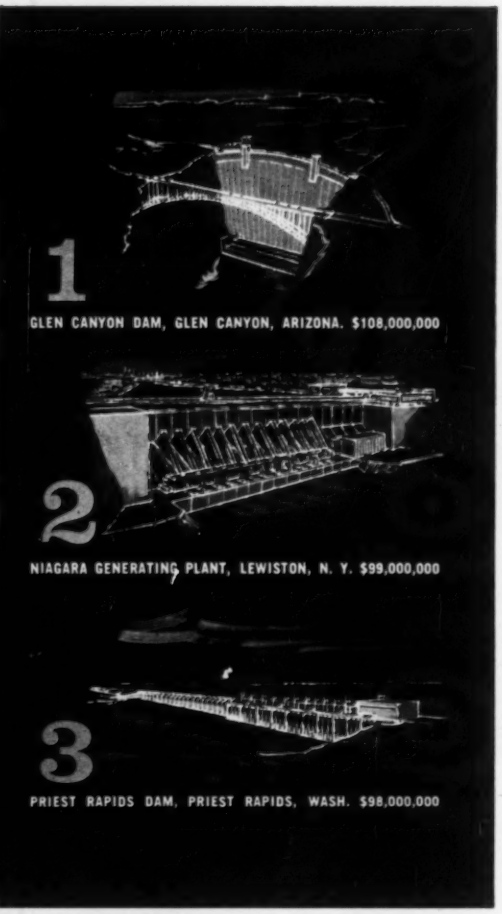
Insert plain end of pipe until it contacts gasket



Force plain end to bottom of socket... the job's done!

Tyton Joint pipe for water main extension in Oklahoma.




1
GLEN CANYON DAM, GLEN CANYON, ARIZONA. $108,000,000
2
NIAGARA GENERATING PLANT, LEWISTON, N. Y. $99,000,000
3
PRIEST RAPIDS DAM, PRIEST RAPIDS, WASH. $98,000,000

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GLEN CANYON DAM, NIAGARA GENERATING PLANT and PRIEST RAPIDS DAM rank 1-2-3 as the largest competitively bid construction contracts ever awarded to a single company. And all three projects fly the Black Horse Flag of Merritt-Chapman & Scott.

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FIVE WORLD-FAMOUS AUTHORITIES present their countries' most significant contributions to the modern science of producing better, bigger dams

1

Andre Coyne of France ranges the world as a dam consultant. Originator of the ski jump spillway and of the use of prestressed cables in dam construction, he is most famed for his bold arch structures. His latest, Roselend Dam in France, is a domed arch that is joined to and helps support a buttress dam.

2

Carlo Semenza of Italy has led the way in the development of the modern hollow buttress dam, and has also designed many arches including 870-ft Vaiont, the world's highest. Head of hydraulic work for one of his country's two major electric utilities, he is also a consulting engineer for work abroad.

3

Tore Nilsson of Sweden is an expert in the cold weather protection of concrete and a world leader in the design of rockfill dams and rock tunneling for underground powerplants. As civil engineering director of the Swedish State Power Board, about half of his country's dam work is in his charge.

4

Henri Gicot of Switzerland is the head of the three-man government board overseeing the design and construction of the 940-ft Grand Dixence Dam, highest in the world. He has pioneered in the use of wide joints in concrete dams for cooling purposes and in grouting procedures to improve poor foundations.

5

Calvin Davis of the United States, early expert on Ambursen buttress dams is now president of Harza Engineering Co. where his practice is worldwide and all inclusive. Current projects include Priest Rapids on the Columbia, the 600-ft Karadj arch in Iran, and the 440 ft Derbendi Khan rockfill in Iraq.

World Progress in Dams

WORLD attention will be focused on dambuilding next week when official delegates from 43 countries meet in New York City at the Sixth International Congress on large dams. This attention is proper: There's been more progress in dambuilding in the last 25 years than in all previous recorded history.

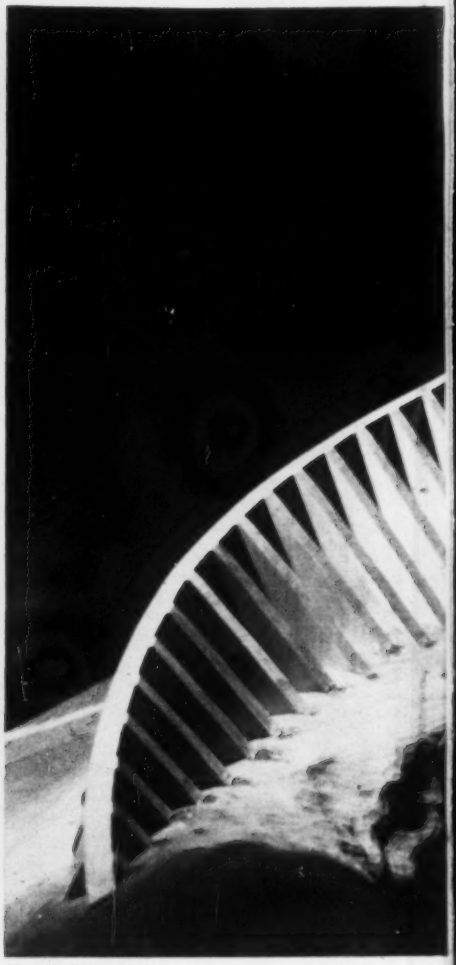
High praise is due a few pioneers of the previous quarter century, but it is engineers now living who have pushed dam design almost to the limit of their dreams. Moreover, in concert with today's dambuilders and construction equipment manufacturers, they have converted so many of these dreams into reality that every major type of dam—concrete gravity, concrete arch, concrete buttress, earthfill and rockfill—is now represented, somewhere in the world, by a structure that far surpasses any predecessors.

Most of this progress has stemmed from the efforts of the engineers and constructors of a relatively few countries where water is so abundant it demands to be stored—for power generation, for domestic and agricultural use or for the control of devastating floods—and where the economic situation is favorable enough to permit the demand to be satisfied. It is the engineers of these favored countries, too, who have spread their talents and their teaching into less developed regions with the result that the roster of notable new dams is indeed worldwide.

Prominent among the countries that have led this dambuilding advance are France, Italy, Sweden, Switzerland and the United States. Their contributions, to the science of producing better, bigger dams are presented in the five articles on the following pages. The authors are outstanding engineers who have played prominent roles in dam progress around the world.

• • •

ULTRA-THIN Le Gage arch dam, built partly as a research experiment, proved to have a safety factor of over 3 and was deemed to be at the economic limit for slenderness.



ROSELEND DAM, now under construction, will be an arch flanked by buttressed

Better, Bigger Dams—

The French Contribution

Andre Coyne
Consulting Engineer
Paris, France

It is in the field of arch dams that the French engineers have made their most notable achievements during the last few years. They have thus not lost sight of the lesson given at the beginning of the century by the American pioneers, and confirmed by the masters of the early thirties, Joergensen and Noetzli—only to mention the greatest names.

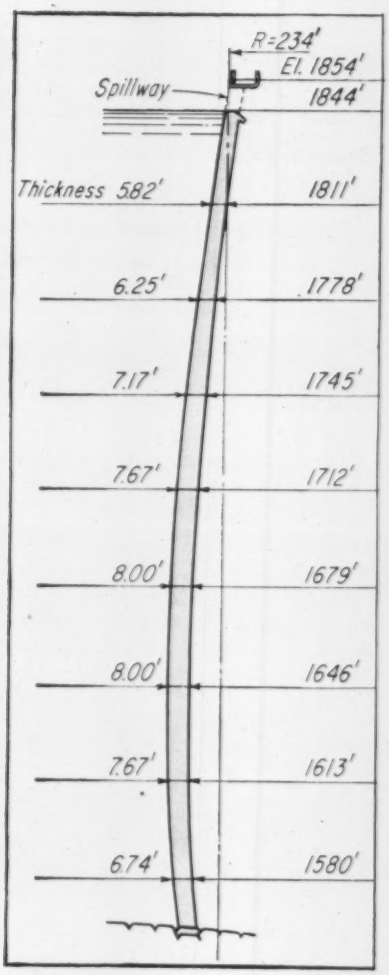
It might even be tempting to call them prophets. Experience has proved, beyond all anticipations, the merits of their views on the great reserves of stability in these arch structures, even in conditions farther and farther from those that seemed possible only 10 years ago.

The first step was the dome shape. If we are not mistaken, it was introduced by the author on the Mareges Dam in 1935. Since then it has become clear that, for equal stresses, the use of the dome is the best way of saving concrete. It is also the best way of saving stresses for equal volumes of concrete. It is above all the only way of overcoming certain vertical tensile stresses, which in any case turn out not to be detrimental.

• **An ultra-thin arch**—Without paying too much attention to this purely theoretical aspect of the question, however, it was more worthwhile to try to discover just how far the refinement of arch dams could go. The idea was to find out, through actual experience, just where we stood in respect to their factor of safety. Since the first moment such structures came into being, the question has received no satisfactory answer.

Research in this direction was the basic reason for building Le Gage Dam (above), an ultra-thin arch designed both for experimental purposes and as a permanent investment. This was achieved thanks to an owner particularly open to the idea of progress, Electricite de France. This dam merely reproduces, to double the scale, Stevenson Creek Dam, which was constructed for the same purpose 32 years ago in the

wings, with some of the buttresses bearing on the arch itself. It will be 494 ft high, 2,630 ft long and contain 1 million cu yd of concrete. The highest buttresses are 197 ft.

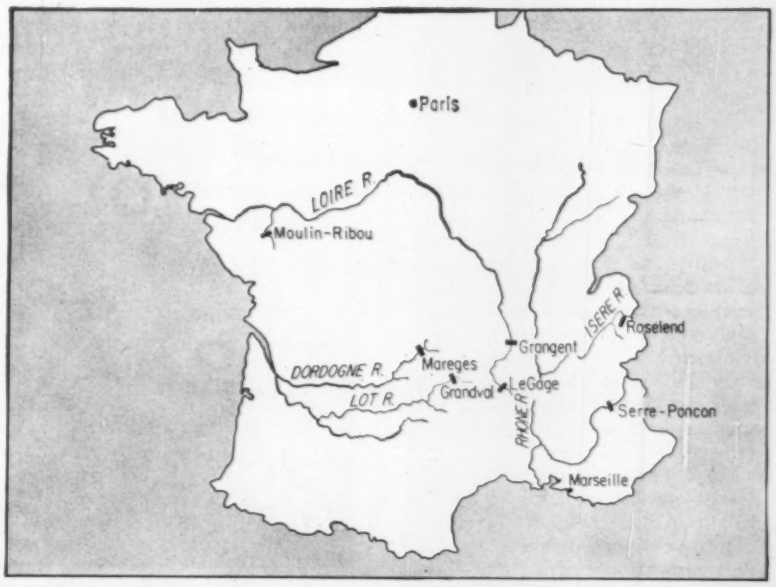


TOLLA DAM is twice as high as Le Gage and built to same proportions.

United States. It is 125 ft high and 470 ft long at the crest, where its thickness is 4.25 ft. The base thickness is only 8.5 ft, and the dam contains 6,000 cu yd of concrete.

The undertaking was crowned with success. It showed that, in this case, it was impossible to prevent tensile stresses at the base of the central cantilever, where a crack appeared, and also that these tensile stresses did not affect the general behavior of the structure. The compressive stresses did not go much beyond 1,400 psi, which would seem to indicate a factor of safety between 3 and 4.

Obviously, unless failure is to be approached yet more closely, no attempt to go any farther in the direction of refinement seems desirable, for the very simple reason that nothing more can be gained. The volume of concrete already has been diminished to such an extent that any fresh economy would be practically reduced to nothing by the site expenses. From a purely economic standpoint, it would have been sheer



LOCATIONS of some of France's notable recent dams. With others, both at home and abroad, they illustrate the French contribution.

. . . Arch dams are moving into wider valleys

GATED SPILLWAYS can be readily installed on top of arch dams and supported either by a thickened crown as at Ait-Ouarda Dam in Morocco (left) or by piers as at Grangent Dam on the Loire River. Of Ait-Ouarda Dam's 148 ft height, 83 ft is below the riverbed.

nonsense to construct Le Gage Dam if the required concrete had not been brought in trucks from a nearby damsite, in the same way as for Tolla Dam (p. 33) directly derived from it, but carried to a height of 280 ft and containing 26,000 cu yd of concrete. The site of Tolla was a narrow, hard granite gorge, lending itself admirably to slenderness.

• **Arch dams for wide valleys**—The adaptability of arch dams does not, however, stop here, for they have proved their usefulness in wide valleys, hitherto considered the exclusive preserve of other types of structures. By wide valleys are meant those where the ratio between the crest length and the height is over 5, and may reach 10, 12 and even 15.

In this respect, an experiment has just been carried out at Moulin-Ribou Dam near Cholet (at right) on a tributary of the lower Loire. This dam has horizontal articulated joints at two different levels. The reservoir was filled recently, and thorough investigations of its behavior seem to prove that the arrangements adopted for hinging the cantilevers could be simplified, or even eliminated.

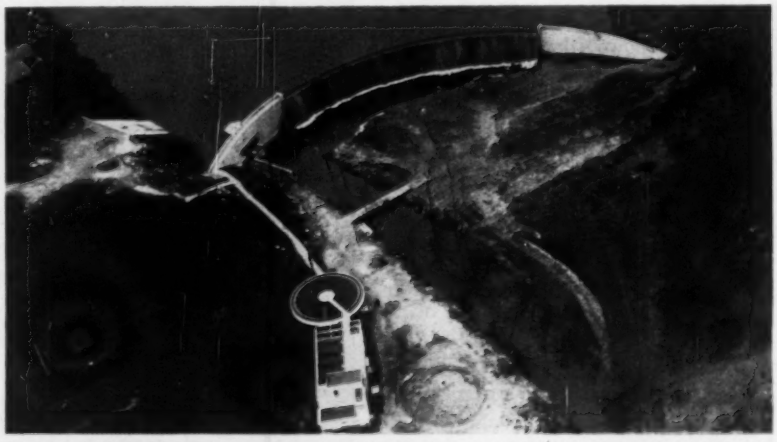
Briefly, Moulin-Ribou Dam (46 ft high and 560 ft long) was a sort of small-scale model, which proved most valuable for large structures where, for a height of 325 to 400 ft, it no longer seems extraordinary to have a crest length of over 2,000 ft for either U-shaped or V-shaped valleys.

It goes without saying that this will influence the shapes of dams. This emerges both from the design computations and from the model tests. In certain cases, the crests will have to be thickened. The layout, parabolic instead of circular in plan, is also questionable, but here there is, so far, no final answer. Nevertheless, vast new horizons open out, and it thus must be possible to extend the advantages of arch dams to a domain that has hitherto seemed closed to them.

• **Arch dam economy**—It will be more and more difficult to compete with these structures, not only from the point of view of the cost of the dam itself, but above all from that of the total cost, which includes the spillway and the diversion tunnels. These are reduced to a minimum for concrete structures, whereas in the case of earth or rockfill dams, they represent a large part of the investment.

As examples of economy on the spillway of an arch dam, it is interesting to note Ait-Ouarda Dam in Morocco and, above all, the more recent and larger dam of Grangent on the Loire (above). On this latter dam, which is 180 ft high and 650 ft long, the contribution of the crest arcs has been eliminated because there is a large gap in the crown. The crest is topped by 46x41 ft gates supported by gravity piers placed on the summit of this thin arch.

Finally, as far as single arches are concerned, intuition and the model tests show that there is no impelling necessity for giving them horizontal abutments. In this respect, Stewart Mountain Dam in America gave us food for thought.



WIDE VALLEYS can be suitable for arch dams, as Moulin-Ribou Dam illustrates. Its cantilever elements are articulated at two levels, but such details may not be necessary.

Forging Ahead at Priest Rapids. This photograph shows construction work on the 1025-ft powerhouse at Priest Rapids Dam, a four-year building project that started in July, '56. Tremendous progress has already been made. Both the Public Utility District of Grant County, Wash., and the Northwest Power Pool can soon look forward to vast new supplies of electric power. Ten generators with a total rating of 788,500 kw will be installed in the powerhouse.

Enormous loads of materials are handled each day as construction proceeds. Cranes and other equipment require great quantities of wire rope, and Bethlehem is furnishing virtually all of it. The rope is supplied in the Purple Strand (improved plow) grade, which has the toughness and strength for any demands imposed upon it.

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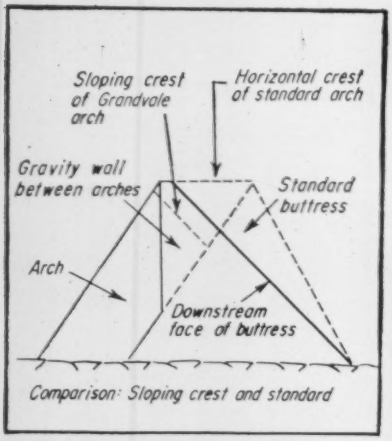
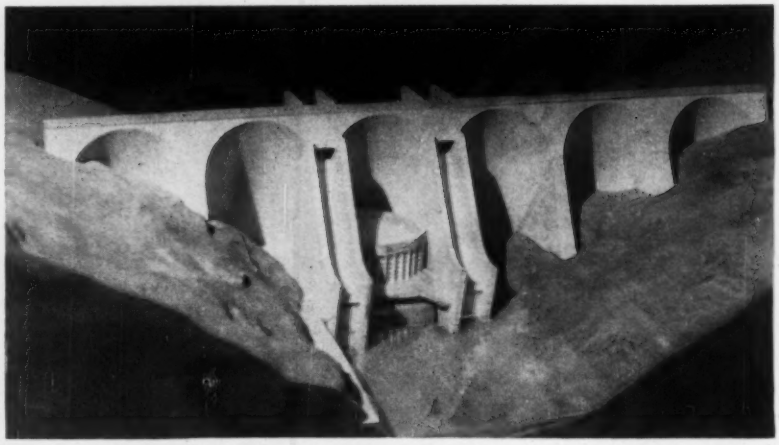
. . . Arches do not need horizontal abutments





INCREASED STABILITY AND ECONOMY in a multiple arch dam results when the crests of the arches slope downstream as in the model at Grandval Dam (right). The sketch (left) shows how this type of dam varies from the conventional design.

Thus at Roselend Dam, a 493 ft high arch now under construction by Electricite de France in the French Alps, the upper half of one of the banks is flat (p. 32). The upper part of the arch, therefore, is not supported by the rock. It was considered superfluous to build massive abutments right up to the crest for taking the thrust of the arch, since this thrust is only considered as being horizontal to satisfy the mind. At Roselend, the arch itself, which is leveled off obliquely, transmits the sloping thrust exerted on the upper part direct to the foundations.

The maximum stresses in Roselend Dam will be about 1,065 psi. There will be no tensile stresses. As an added point of interest, the dam will have lateral wings with buttresses, some of which will rest on the arch itself.

• **Multiple arches**—Roselend gave rise to a fresh idea, applicable this time to multiple arch dams, a type of structure whose career is far from being ended particularly for very wide valleys. The idea consists in cutting through the buttresses and the crest of the arches of an imaginary standard multiple arch dam by a sloping plane running from the downstream toes of the buttresses to the middle points of the crests of the arches so that the upper parts of the arches slope down on the downstream side instead of being horizontal. This is shown in the model of Grandval Dam (above). This would leave an opening over each buttress, but in reality these openings are plugged by a kind of vertical wall similar to a small gravity dam.

The weight of this wall is a valuable contribution toward the over-all stability of the structure. Subject to the precautions required for connecting it to the higher parts of the arches, certain excess volume can be eliminated in the other parts.

In this way the amount of concrete can be reduced to one-third or even

CONVENTIONAL MULTIPLE ARCH is the Oued Mellegue Dam in Tunisia, 230 ft high with arches of 165 ft span.

TEMPORARY OPENINGS in the arches of multiple arch dams can pass floods during construction. Before the arches are closed the water can flow between the buttresses. This is Oued Mellegue Dam when it was about half finished.

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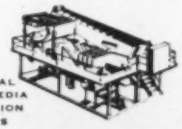

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one-quarter of that for a corresponding gravity dam—and even to less than that required for a hollow gravity dam.

Where the span of the arches of such multiple arch dams is great—a thing which is not difficult to achieve—no more formwork will be required than for a gravity dam, sometimes even less. The extra cost depends entirely on the amount of labor employed. The cheaper the labor, the greater the economy, and in most of the underdeveloped countries of the world hands cost but little.

As for the general shape of the structure, it is very close to that of the American multiple dome at Coolidge Dam in Arizona, which can be considered one of the oldest cousins of modern multiple arch dams.

On quite a different scale, it is proper to mention that the invention of the small bulb-type turbine-generator permits a complete transformation of the structure of low-head dams with buttresses, since the units can be placed in the buttresses. This innovation is particularly applicable to tidal power stations (ENR June 14, 1956, p. 36).

But it is not mere reduction of volume as against gravity dams that constitutes the main advantage of multiple arch dams. Even if this economy on volume does not influence prices to the extent anticipated, the total cost and construction time for structures completed and ready for operation remain to be compared.

Then again, if multiple arch dams are confronted with their most direct competitors—which are earth or rockfill dams, since gravity dams must seemingly be rejected because of their prohibitive cost—the first snag is often the problem of spilling floods during construction. Account has to be taken of the time lost and the money expended on long diversion tunnels, which may be used perhaps only once, or never, and on high upstream cofferdams, themselves at the mercy of overtopping.

Covering this serious risk is very often inevitable, but the cost is frequently exorbitant even, if perchance, such tunnels can be utilized subsequently as intakes or as outlets for a tunnel spillway. Moreover, if such tunnels are used as intakes, their extreme length may lead to the construction of expensive surge chambers placed close by the power station and rising up to the upstream water level.

Once the structures have been protected at huge expense from the threat of the floods that can reasonably be anticipated during construction, it will only be rarely that such measures will prove adequate for the final spillway. This will have to be able to stand up to the hundred or even the thousand year flood for it would be unwise to attempt to rely on sheer luck or to leave the slightest loophole to contingency.

The only thing to be done then is to open a large trench somewhere and to line it with concrete, unless by some stroke of fortune there is a saddle spillway available. Even this can prove unreliable without adequate knowledge, for regressive erosion is a dangerous weapon if handed over to a fickle river to wield according to its good pleasure.

What then could be simpler than letting the water pass through the intervals between the buttresses of a multiple arch dam under construction, if of course the foundations are safe from scour? One or two small—very small—galleries, just adequate for the dry sea-

EARTHDAM CONSTRUCTION at Serre Poncon on the Durance River. Founded on an alluvium, made watertight by grouting, the dam will be 395 ft high and 1,975 ft long. It will have a volume of 18.5 million cu yd.

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. . . Earth dams, too

son would suffice for the period required to construct the foundation in the river. Later on, temporary openings in one or two of the arches can provide spillage for the floods (p. 36) until the final spillway or spillways are ready to operate. They, of course, are located on the structure itself. Thus, incidentally, the filling of the reservoir can start before the dam itself is completed.

As for the power station, placed at the toe of the dam, it is connected to the reservoir direct through a few meters or at the most a few dozen meters of concrete.

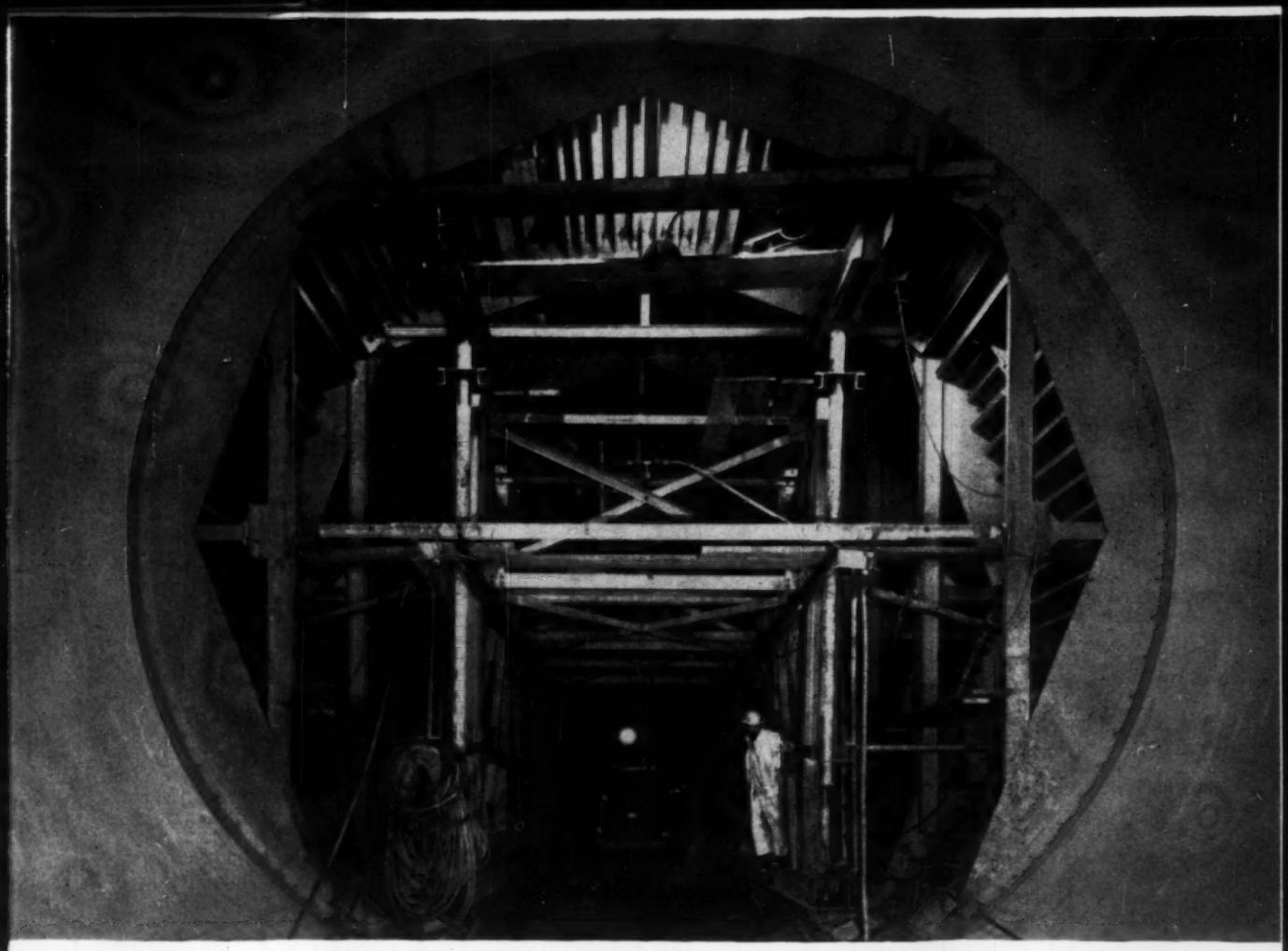
It is not surprising that all these cumulated advantages weigh down the scales on the side of concrete dams, whatever may be the future progress and saving realized by earth or rockfill techniques.

• **Embankment dams**—This reasoned prejudice of French designers in favor of concrete dams does not imply any fundamental prejudice against earth or rockfill. For instance, Souapiti Dam in French Guinea is to be made of earth materials. It will be 410 ft high with a crest 3,300 ft long. The total volume of earth will be 29 million cu yd. The material used will be laterite, a residual product of the decay of the rock most often found in tropical latitudes.

On the same lines, the construction of Serre-Poncon Dam on the Durance, in southern France, was started in 1953. Here because of a foundation layer of alluvium, sometimes as deep as 360 ft, a massive earth dam (p. 39) was considered more suitable. The foundation was rendered watertight in a most original way—by injecting a 33,000 sq ft cutoff area in the riverbed with various kinds of grout, composed on the one hand of mixtures of varying proportions of clay and wet crushed slag cement and on the other of bentonite fluidized with a sodium silicate admixture. Perviousness was thus reduced by 5×10^{-2} cm/s to 10^{-4} and even 10^{-5} cm/s.

• **Meeting a special problem**—The disadvantage of earth or rockfill dams mentioned above sometimes can be overcome by combining an embankment with a concrete structure. A case in point is Djatiluhur Dam on the Tjitarum River in Indonesia.

The foundations are composed of alternate layers of sandstone and claystone, the latter being somewhat analogous to the famous bearpaw shale met with in certain regions of North America and Canada. The claystone predominates. On the surface, under the action of weathering, it has turned into yellow unctuous clay, fluid in the rainy season and giving rise to numerous



Design of traveler permits vehicular operation through tunnel while form is in place. In addition Blaw-Knox developed and built a concave screed for the tunnel invert.

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With these specially designed units, Trinity Dam Contractors poured every day, alternating between forms, allowing 16 hours set-up time. Using other methods, a maximum of only two pours a week would be possible. Guy F. Atkinson Company is sponsor of the $49,000,000 joint venture. Other joint venturers are: M. J. Bevanda Co., Inc., Chas L. Harney, Inc., Ostrander Construction Company, A. Teichert & Son, Inc. and Trepte Construction Co.

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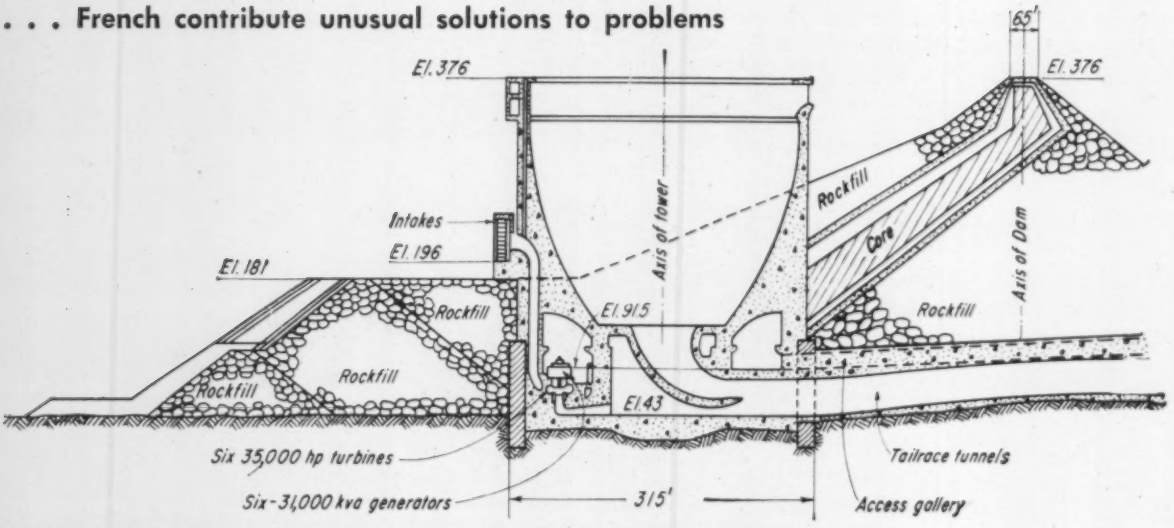
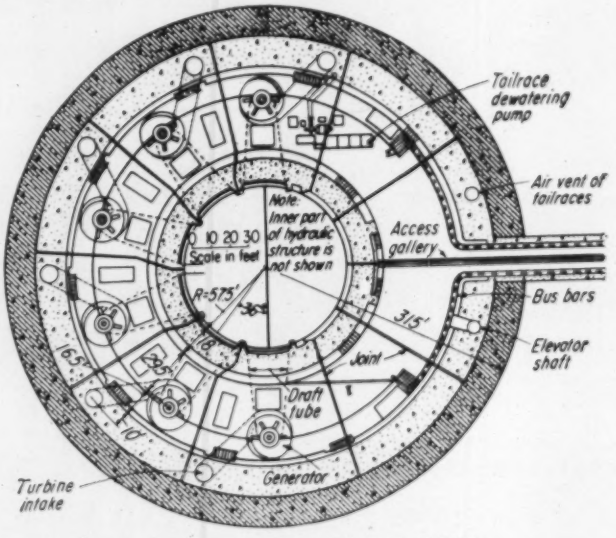
. . . French contribute unusual solutions to problems



CROSS SECTION OF TOWER AND DAM



PLAN OF TOWER AT TOP OF GENERATORS

UNIQUE DAM IN INDONESIA will combine a rockfill embankment with a circular concrete structure, which serves the multiple purpose of spillway, intake and powerhouse.

landslides, which render the adoption of a concrete dam highly inadvisable. Moreover, it would have been extremely costly to install intakes and a spillway in this ocean of mud. And, finally, stripping and removing the worst part of the overburden would constitute no adequate guarantee that the weathering process would be arrested.

The Indonesian dam is to be a rockfill, 300 ft high and 3,000 ft long with a volume of 9.3 million cu yd. It will have a sloping core.

What is new is that all the appurtenant works, i.e. the intakes, the power station and the spillway, are combined in a single building, in the form of a large concrete tower about 315 ft outside diameter and 333 ft high. Its foundations are to be set deep, and it will be embedded in the rockfill as shown in the drawing on this page.

Floodwaters will spill right round the upper perimeter, arranged as a free-flow spillway, and be collected at the bottom, running off through two underground galleries on the downstream side. As the tower will be built up at the same time as the embankment, while remaining somewhat lower, it will serve as an emergency spillway during the whole course of construction. In these circumstances a single small diversion tunnel will suffice, as it will only have to play its part during the construction of the upstream cofferdam.

The greatest departure from precedent, however, is the fact that the hydroelectric power station is placed inside the tower itself, practically at the point of impact of the spillway jet. This daring innovation secures at the same time the following advantages:

1. Direct and very short intakes through the walls of the tower.

2. Elimination of penstocks under the rockfill, which would certainly have given rise to serious problems in such poor foundations.

3. Elimination of surge shafts at the outlets of the units, as the tower fulfills their function.

As anticipated, hydraulic model tests showed that there is no major obstacle to mixing the wild water from the spillway with the tame water from the turbines, provided a few simple precautions are taken. The evacuation conduits for the water from the spillway can thus also serve quite naturally as an extension of the tailraces. An important point is that the energy of the spillway jets is partially dissipated in the tower itself. In this way the speed in the tailraces, and in the stilling pool from which the water returns to the river, can be slowed down, with resulting reduction of erosion.

These arrangements as a whole are the outcome of the research and realizations we have pursued over about 20 years, both on arch dams and on the question of spillways incorporated in the structures, particularly on the roof of the power station itself. This latest jump into the blue is thus reduced to the proportions of a calculated risk—by the extrapolation of previous experience hitherto crowned with success.

Whether new wine is put into old wineskins or whether, on the contrary, old ingredients are so mixed as to render them tastier with that grain of salt which is imagination, progress is achieved step by step, relentlessly. This is the true French touch in the art of dam building.

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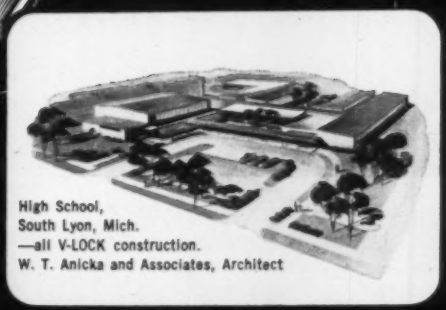

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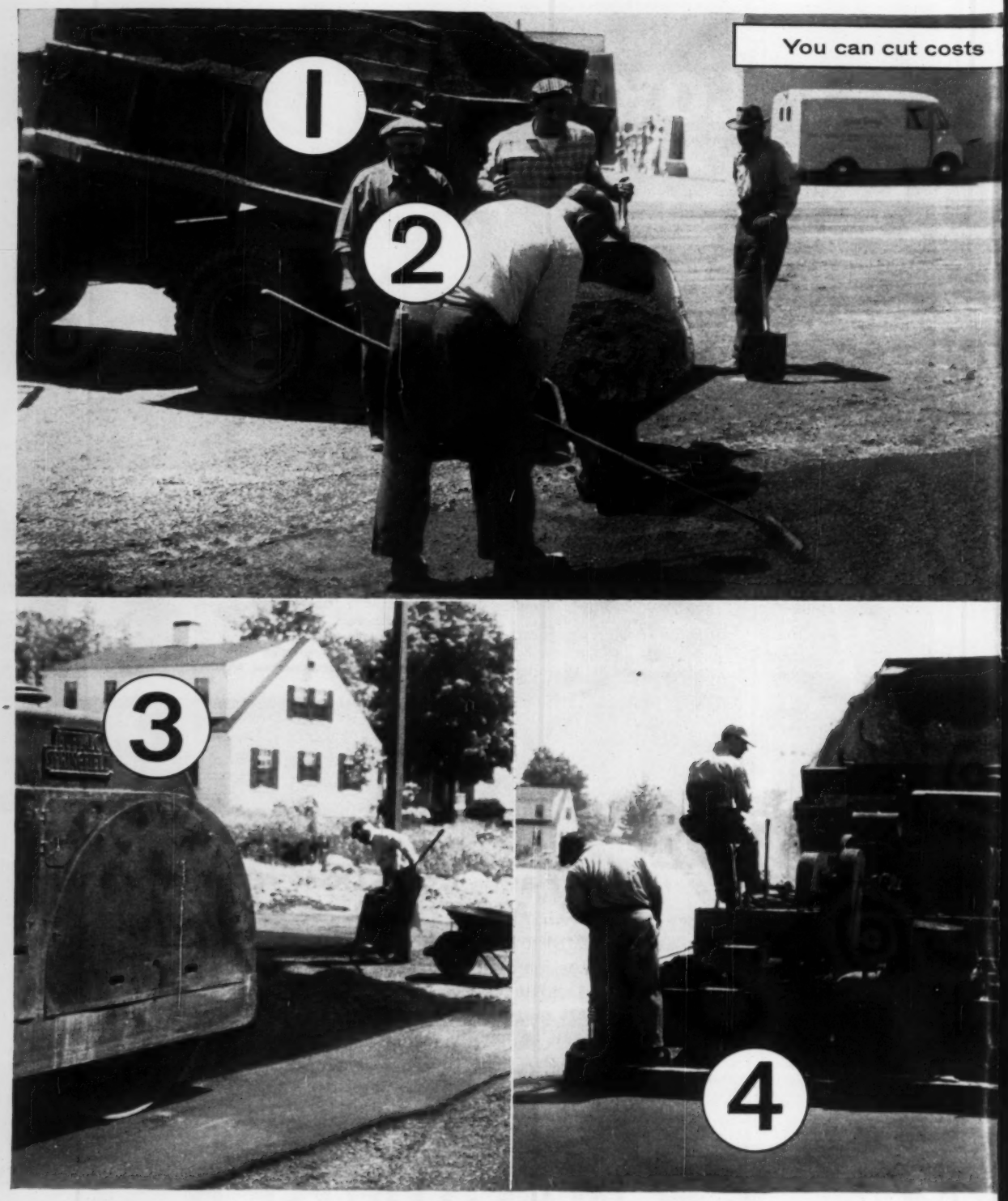

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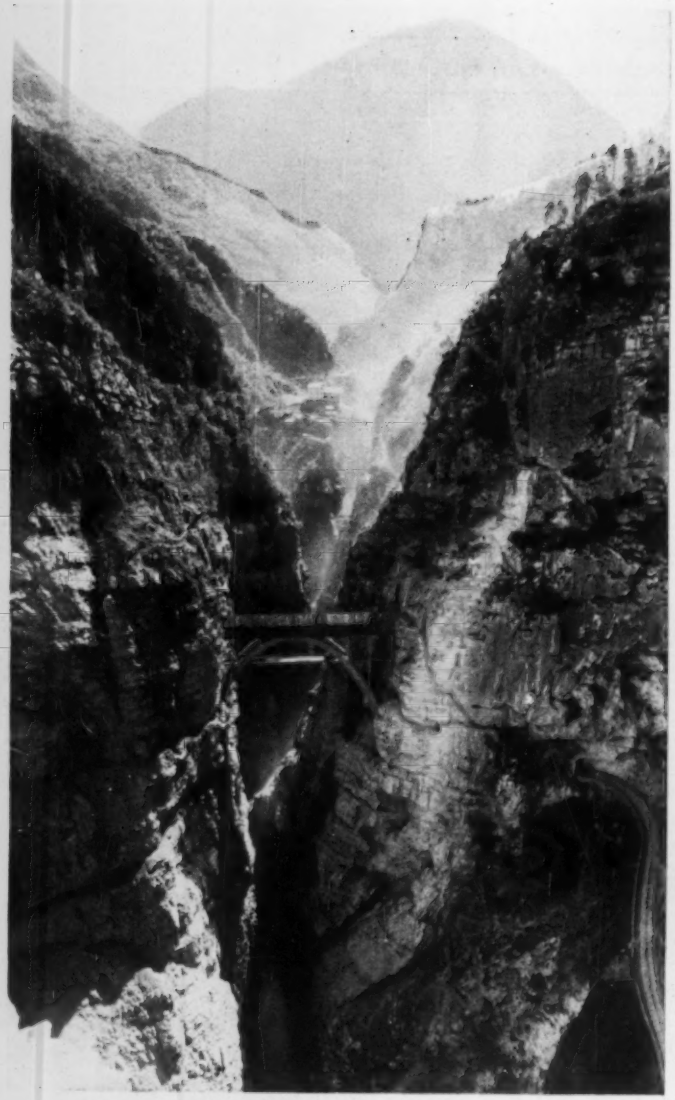
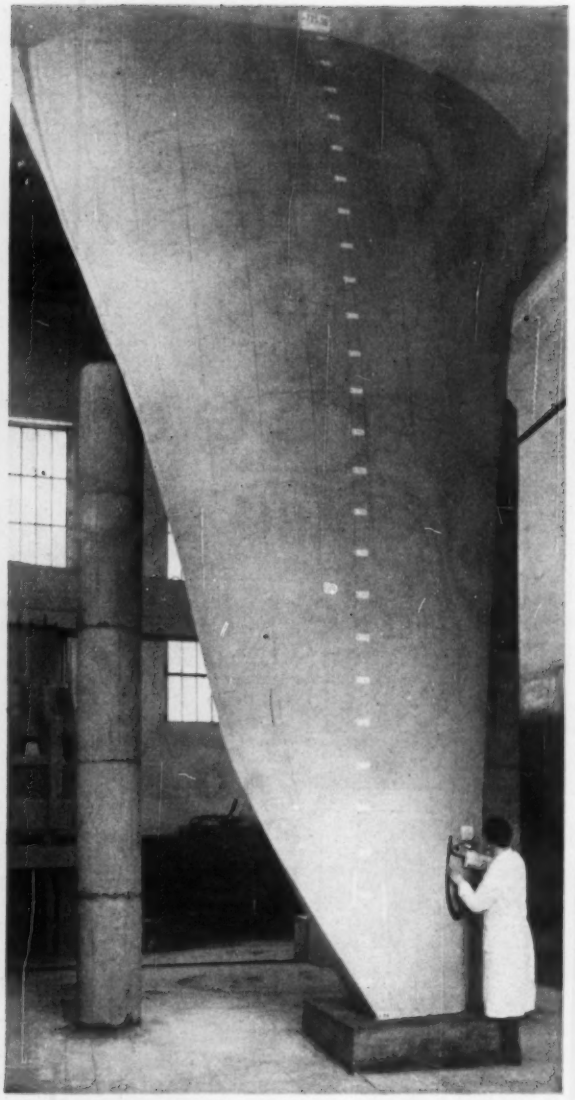


GORGE IN THE DOLOMITES of North Italy where Vaiont Dam is being built. It will rise to a height of 865 ft.



DAM MODEL TESTING is widely practiced in Italy. This 1:30 model of Vaiont Dam is 29 ft high.

Better, Bigger Dams—

The Italian Contribution

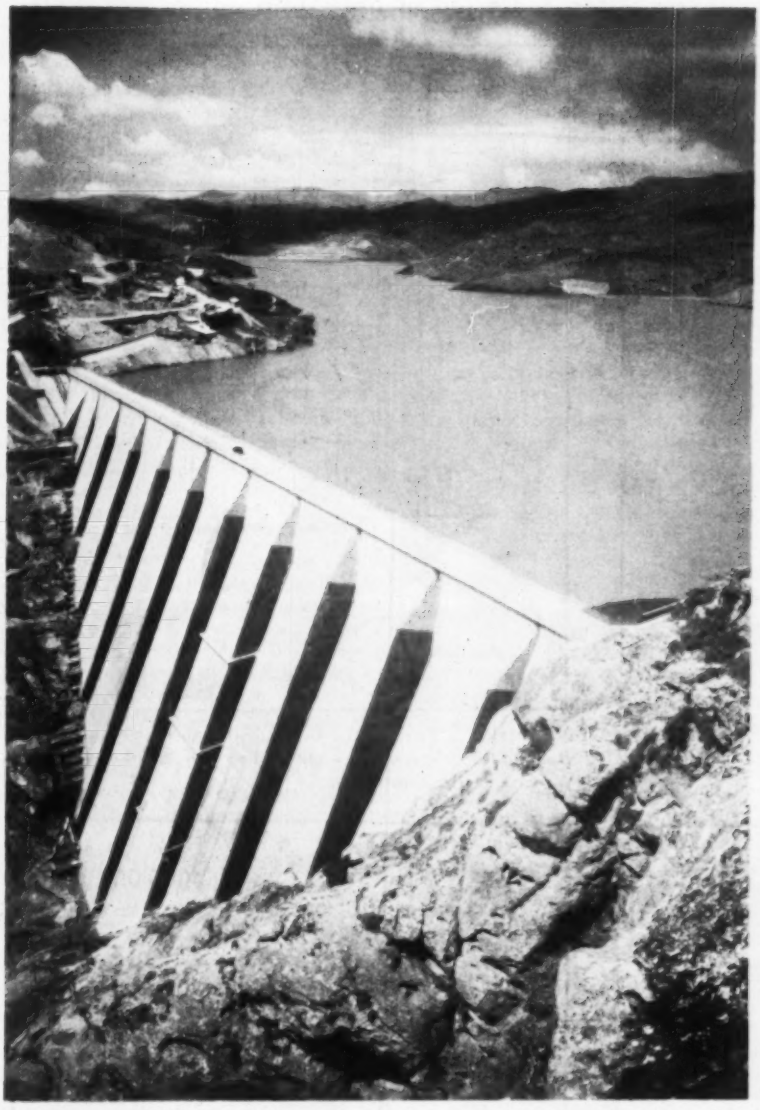
Carlo Semenza
Manager
Hydraulic Construction Department,
Societa Adriatica di Elettricita, Venice

The technique of dam construction has had a long development in Italy, and several 15th and 16th century masonry structures are still in service. But it is in the last few decades that the most varied and extensive achievements have been made. This has happened largely because exploitation of the country's scarce hydraulic resources, both for agricultural and industrial purposes, requires many large reservoirs to store the water from streams with very irregular flow-rates.

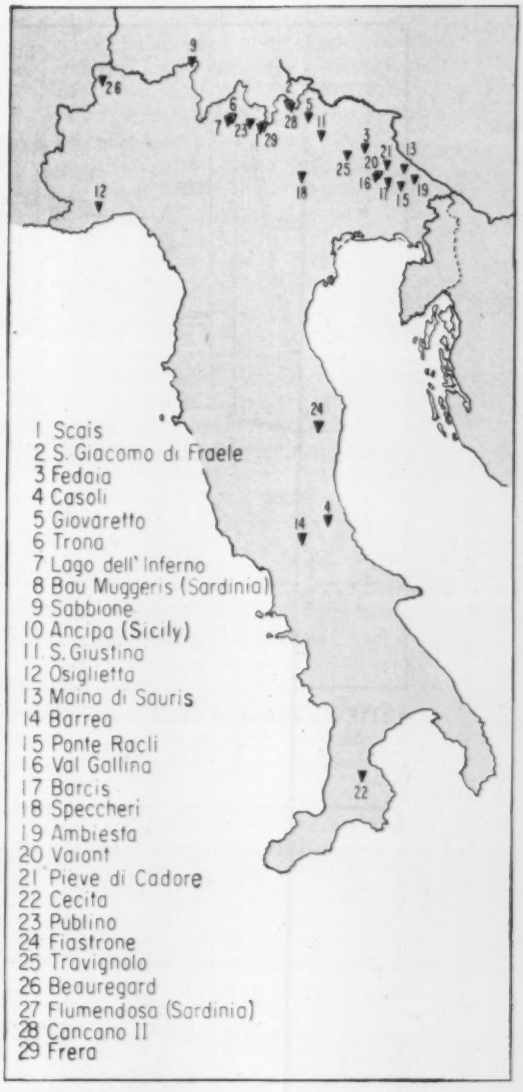
To outline briefly the evolution of this technique and the directions in which it is developing is difficult because of the variety of the trends and the number of structures. I shall therefore confine myself to a brief presentation of the main data of this evolution followed by comment in greater detail on the present technical trends and their most characteristic aspects, with particular reference to hollow buttressed dams and to arch structures.

• **Numbers and types of dams**—Over 300 dams were in operation in Italy last year. This figure refers to structures with a height of more than 33 ft and a storage volume of more than 80 acre-ft. Actually, the majority are much larger. Approximately 70% of the dams are higher than 80 ft, and 14 of them are more than 330 ft high.

In addition, about 40 dams were under construction in 1957—eight of them



HOLLOW BUTTRESS DAMS have been developed to a high state of efficiency in Italy. This one, Ancipa, in Sicily, is among the highest of this type in the world, 368 ft.



ITALIAN DAMS, mostly clustered in the Northeast, illustrate trends in design.

higher than 300 ft. Thus Italy holds, if I am not mistaken, an important place (perhaps third) among the world's main dam-constructing countries.

Italian dams have been built mostly for hydroelectric purposes; many combine this aim with irrigation and other purposes, while about 10% serve irrigation only. According to fairly complete statistical data, which we have derived from recent personal investigations, Italian dams in 1957 were of the various types shown in the table (p. 49).

The largest group, 54% of the total, consists of gravity structures, both massive and hollow. But the number of single-arch dams (arch, dome and arch-gravity) is also considerable (21%). The group of earth dams is smaller; and even less numerous are the rockfill ones, although their number is decidedly increasing. An interesting achievement in the last few years has been the construction of some dams made of concrete blocks.

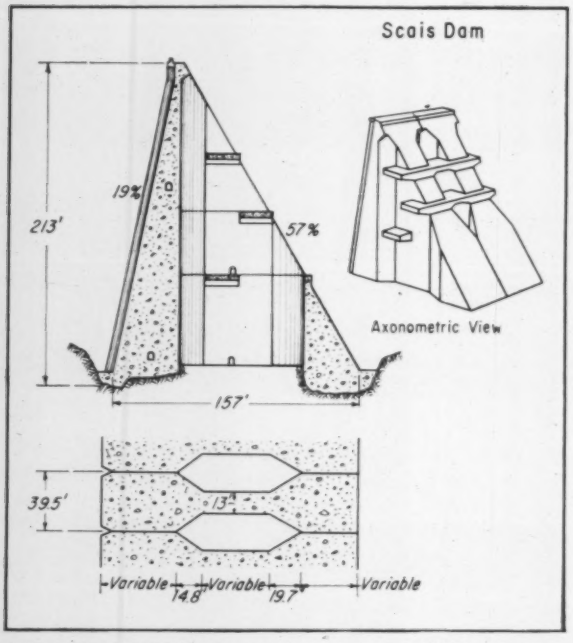
Dam construction was particularly active in the 1925-30 period and then again during the last decade. At least 120 dams have been built since world War II, of which nearly 50 are arch and arch-gravity structures and 16 are hollow. How the maximum heights of these dams have increased is shown in two graphs (pp. 50 and 53).

• **Evolution of dam types**—It is evident from the accompanying table that the principal types of dams have been the object of uninterrupted interest on the part of Italian designers from the beginning of the development of our dam technique until today. Slab and multiple-arch dams are perhaps the only exception; after enjoying a period of favor, they have not been adopted in more recent times.

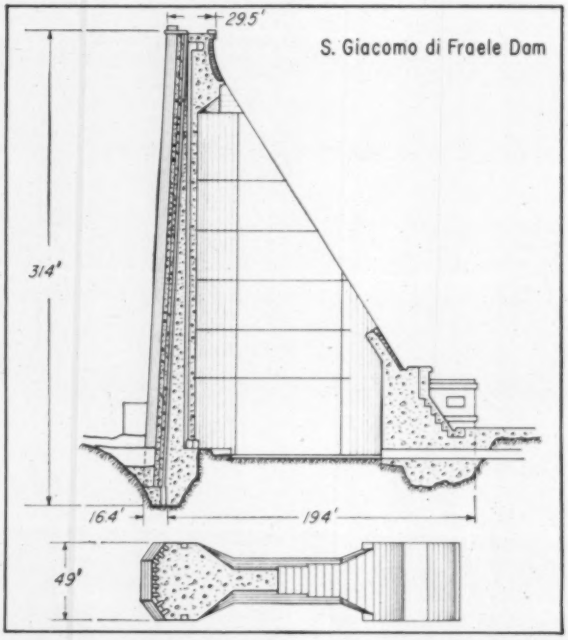
Of course, since the first achievements, every type has undergone continuous and extensive evolution involving all the branches of dam technique—analysis, study of materials, model tests, construction methods and control on structures in operation—as well as geology, geotechnics and other complementary sciences. Italian contributions to all these branches have been large, and in some cases, such as in model technique and structure control, substantial. Of course, as a rule, foreign developments also were studied, and often adopted.

The most evident result of the ensemble of these studies and amassed

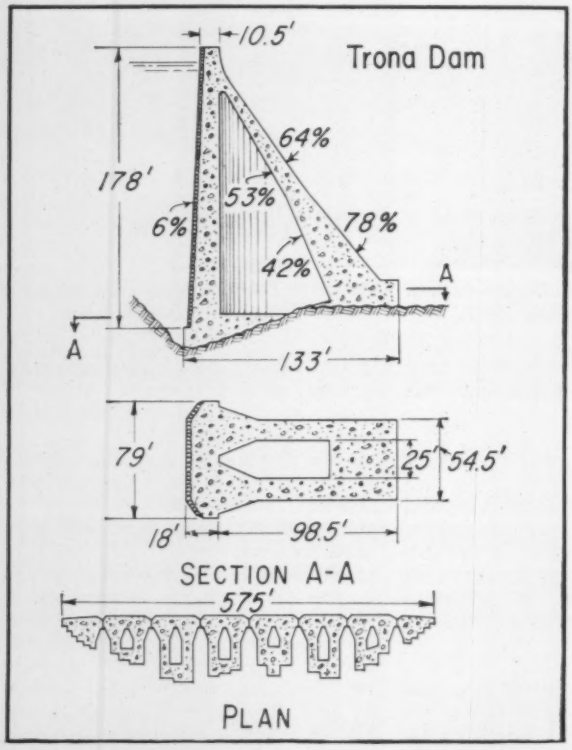
. . . "Hollow" dams, buttress types, are often preferred in Italy, and domes are preferred



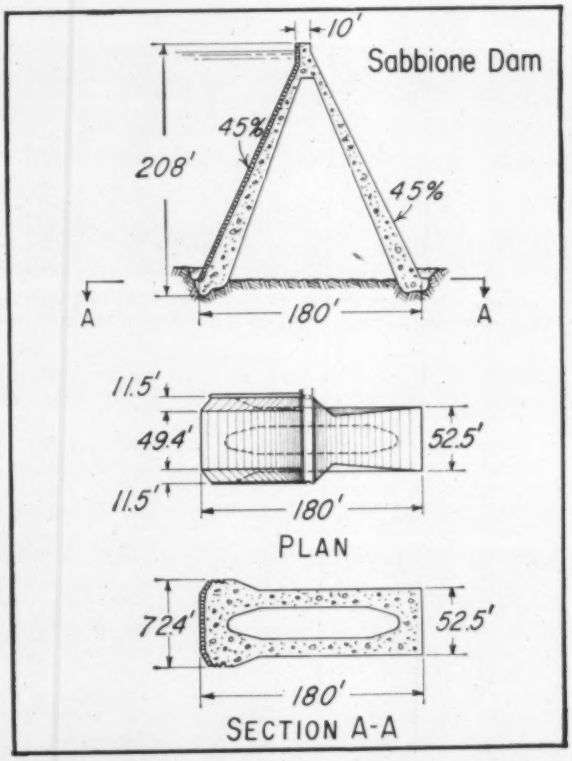
BUTTRESS DAMS of the so-called "independent" buttress type are characterized by "hollows" provided between the individual buttresses. Scais was the first dam of this type (1936-39) while



S. Giacoma di Fraele is the largest. Altogether, Italy now has 19 dams of the buttress type—independent and hollow—either completed or under construction.



HOLLOW BUTRESSES characterize the "double" buttress type of dam. By putting the "hollows" in the buttress itself, wider buttresses and therefore fewer joints result than in the "independ-



ent" buttress type. Trona Dam was the first of this type (1939-42) while Sabbione is a later variation in which the upstream face is sloped for greater stability.

among arch types

experience is the evolution of the basic types toward what we may call derived types. Hollow dams are now often preferred to gravity dams, dome dams to arch dams, earth dams with waterproof protections, screens and other devices to simple earth dams, etc. At the same time, the field of application of every type gradually has been extended.

According to the foregoing, we can say that Italian designers—like any scrupulous designers—have always adhered strictly to the concept that each dam must be considered as a particular problem to be studied and solved on its own merits. This implies a previous study of numerous alternative designs, which generally are developed far enough to permit a reliable cost estimate. As a rule, these designs also include a check of the estimated operation and maintenance costs of the project. This method of study is sometimes long and expensive, but experience has amply demonstrated to our designers that the subsequent savings in the construction cost and in the operational stage in most cases far outweigh the increased expenses at the project stage.

Of course, this method of study as such is not originally Italian, nor is it adopted only by Italians. Yet I dare say that in Italy it is followed no less thoroughly than in other countries. Actually, we must build structures as refined and thin as possible, because of the high cost of materials. And this is not hindered by any opposite tendency on the part of contractors to prefer standardized and mass work, as happens in other countries. In Italy, skilled technicians and labor are still rather widely available, and the effect of their cost is less than in many other countries.

The basic approach of our designers, pointed out above, is also to a certain extent related to the independent judgment, individualism and critical mind of our people, which creates an incentive to seek the best possible solutions. Actually, every new construction has contributed, often originally, to the improvement of a particular type of structure.

• **Factors affecting choice of type**—There are a number of factors that are fundamental in the choice of a dam structure in Italy, such as terrain, legal codes, materials and economies.

As to the ground on which Italian engineers have to operate, its nature is varied, both from the morphological and the geological point of view. In the Western and Central Alps, as well as in crystalline or metamorphic formations in general, damsites are often wide and irregular so that they are usually most favorable for the construction of gravity or hollow dams. But in the comparatively recent limestone formations, especially in the Prealps and in the Eastern Alps, deep and, more or less, narrow gorges occur, in which arch dams are appropriate. And finally, in the Apennine formations and in the islands wide damsites are again prevalent.

Locations suitable for earth and rockfill dams were considered in the past to be less numerous than for other types. Yet, the fact that the number of these dams is rather small is mostly due to official limitations, which should be regarded as rather old and thus sometimes practically surpassed. Today's views are being codified. The limitations still in force appear plausible also in connection with the fact that many of our valleys, especially in the Alps, are rather populated. In the last few years, however, several dams of these types have been built in our country, particularly in south Italy.

With regard to materials, stone masonry has been used in gravity dams until relatively recent times, as compared with other countries. This was due both to the large amount of such material available and to the traditional skill of our labor. Now, for many decades, concrete has generally been used, except for face works in severe climates. Extensive technical investigations have led to the use of special types of cement, which are often mixed with pozzuolana. The latter is comparatively cheap, and is found in large amounts, especially near Rome.

Finally there is the economic factor. Great efforts are being made in our country—through model tests, analyses, measurements and observation of the completed dams—to ascertain the behavior of the various structures in the interest of increased safety and economy. Such research is particularly necessary since economic resources are limited and materials are scarce and costly. Great importance, from the above point of view, is attached especially to model tests.

With regard to the various factors of cost, we already have observed that in Italy the cost of labor does not affect the total cost as greatly as in other countries, in comparison with the effect of the cost of materials. As a consequence, low labor costs exert a direct influence on the evolution of dam types, and often contribute to their refinement. High material costs have a similar effect since major efforts are directed toward a better utilization of materials.

Thus it is that the most recent and important developments of dam technique in our country have taken place in the field of hollow buttressed and arch dams—types that utilize materials very economically. Their wider use obviously results also from the existence of favorable topographical and geological conditions. Numerous interesting dams of these types have been built throughout Italy in the last 20 years, but in this rapid review I can only mention a few which, in my opinion, have marked important steps as to conception and realization.

• **Hollow buttress type**—Dams of the hollow buttress type in many variations have been constructed in Italy as well as abroad, but attention here will be confined to those formed by a series of buttresses whose upstream heads are enlarged to full span width, while their downstream ends may be shaped and arranged in different ways; and in these dams, the buttresses can be "independent" or they can be "double." These types of hollow buttressed structures occupy a dominant position in Italy. Actually, the place once reserved to full gravity dams—and partly to multiple arch (or slab) dams—is now practically held by the hollow buttress structure.

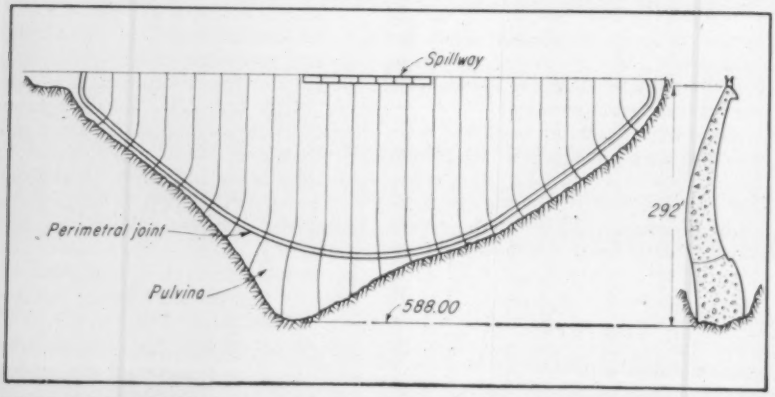
An important example of the "independent" buttress type, and the first to be built in Italy (1936-39), is Scais Dam (see p. 48). It consists of a series of six elements or buttresses, 213 ft maximum height, with a "hammer" or "double T" horizontal section. The inclination of the upstream face is 19%, that of the downstream 57%.

Among Italian structures of this type,

How Italy's 347 Dams Classify as to Types and Construction Periods

Periods of Construction	Gravity	Hollow buttress	Arch and dome	Arch-gravity	Multiple arch or slab	Rock-fill	Earth	Concrete block	Other types
Before 1905	6	..	1	1	..	..	4	..	..
1906–1910	4	..	1	..	..	1	..	..	..
1911–1915	5	..	1	..	..	2	2	..	..
1916–1920	11	..	2	..	2	4	..	..	..
1921–1925	19	..	9	1	3	4	4	..	1
1926–1930	36	..	4	..	5	5	4	..	10
1931–1935	18	..	4	..	..	..	4	..	2
1936–1940	22	1	4	..	..	1	..	..	2
1941–1945	6	2	3	..	..	..	1	..	1
1946–1950	10	3	7	1	..	1	1	..	1
1951–1955	16	5	11	10	1	..	2	2	4
1956–1957 and under construction	14	8	7	7	..	1	8	1	3
Totals	167	19	54	20	11	19	30	3	24

. . . Domed arches often sit on a concrete pulvino



PERIMETRAL JOINT is a new device to separate the dam structure from its foundation and thus improve its stress condition. This is Val Gallina Dam, a highly curved arch dome.

S. Giacomo di Fraele Dam (1940-50) is the largest (see p. 48), being 300 ft high, 29.5 ft wide at the top and 210 ft wide at the base. Its upstream face is almost vertical (3%), while the downstream face has an inclination of 62%. The crown development is 3,260 ft, and the total volume about 800,000 cu yd.

Fedaia Dam, a large structure recently built at 6,500 ft elevation in the Eastern Alps, also can be classified as of the independent buttress type. Its "independent element", however, is quite different from the previous ones. The side surfaces of the buttresses are smoothly varying; and foundations are "cradle" shaped, the downstream edge of the cradle-line being noticeably higher than the upstream edge. The dam has a maximum height of 194 ft, a crown length of 1,063 ft and a volume of 218,000 cu yd. Its base width had to be somewhat reduced in comparison with the previous structures, owing to the particular morphological conditions of the location.

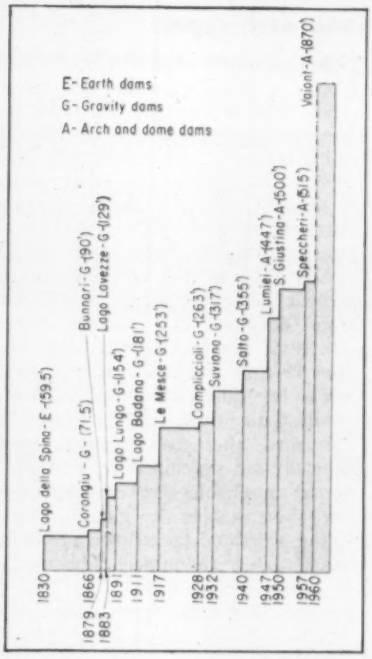
A dam quite similar to Fedaia is being built at Casoli on the Aventino River, in central Italy. It will be 171 ft high; crest length will be 640 ft, being continued by a spillway 210 ft long. The concrete volume will be 107,300 cu yd.

Giovaretto in the Central Alps is the most recently completed dam of the independent buttress type (1957). It has a maximum height of 280 ft, a crown length of 1,250 ft and a volume of 400,000 cu yd.

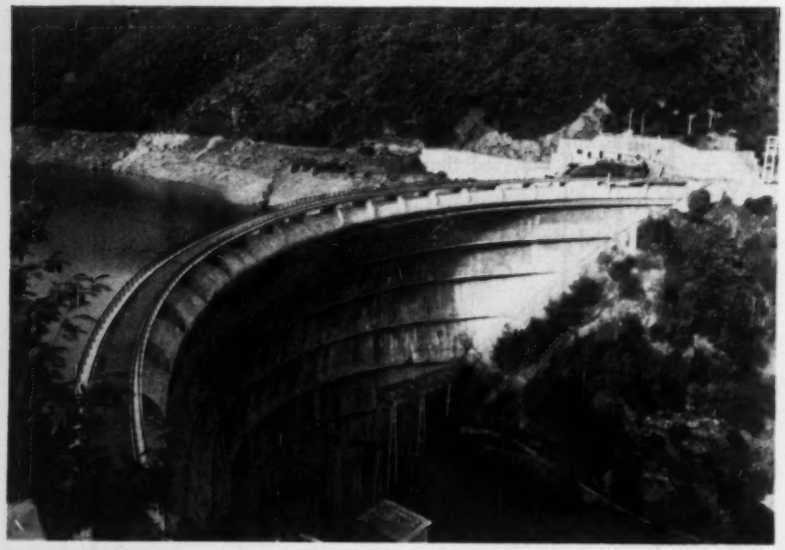
The first examples of what could be termed "double" buttress types are Trona Dam on the Bitto River (1939-42), and the Lago d'Inferno Dam on the Adda River, built soon after. Trona (p. 48) contains six "double" buttresses. Thus the dam consists of a series of hollow elements, which results in larger distances between the joints (79 ft) in comparison with the "independent" element structures. Each element has an almost vertical upstream face (inclination 5%, as usual in gravity dams) and an inclined downstream face, 78%.

A more advanced step in this kind of structure is marked by the Bau Muggeris Dam on the Flumendosa River (1948-49). Here, the buttresses have a different shape than those of the Trona Dam, the inclination of the two faces

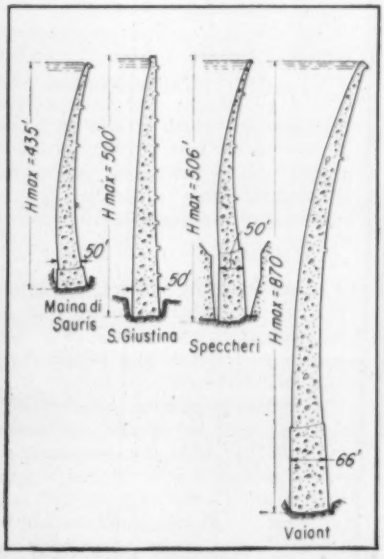
(*Continued on page 53*)



HOW MAXIMUM DAM HEIGHTS in Italy have increased over the years.



SUPPORTED ON A PULVINO, a concrete saddle all along its perimeter, Osiglietta, a domed arch, is the first dam to be built with this special foundation.

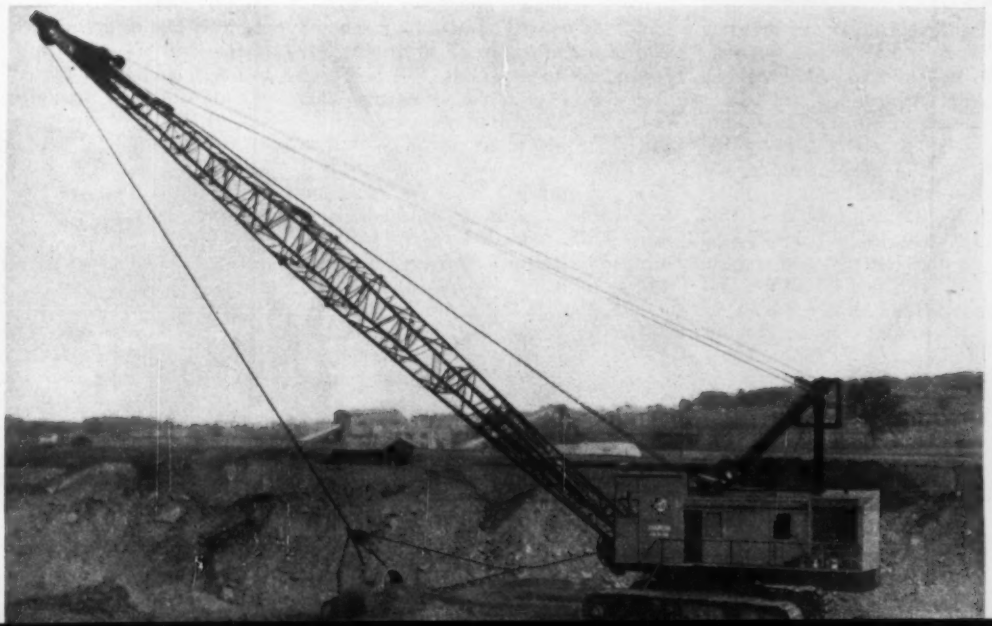


HIGHEST ARCH DAMS in Italy include Vaiont Dam, which will be world's highest.

10-YARD SHOVEL—Marion 191-M shovels, world's largest on two crawlers, are writing new chapters in excavating history at Fort Randall and Oahe dams on the Missouri River.

THERE ARE NO FINER DAM SHOVELS . . . draglines and cranes than Marions, and there's a Marion for every dam job. From 25 ton truck cranes through 35 yard walking draglines, there is a choice of crawler, walker or rubber mounted machines with front end equipment to handle all digging and lifting jobs quickly, economically and dependably. Let us show you how to get more with Marion. Marion Power Shovel Co., Marion, Ohio. A division of Universal Marion Corporation.

8-YARD DIESEL DRAGLINE—Biggest diesel dragline on crawlers, the Marion 183-M moves big yardages involved in dam and irrigation projects at a rate that obsoletes conventional equipment. Ward-Leonard electric swing.



Tough Job Conditions at Hildebrand Dam Beaten by 100% Bucyrus-Erie Lineup

Hildebrand dam and lock are rising on the Monongahela River in rugged West Virginia mountain country 4½ miles upstream from Morgantown. All excavators and cranes on the project are Bucyrus-Eries. These include a 71-B, a 54-B, two 38-Bs, and a 22-B Transit Crane. All have special jobs to perform; all are doing them well.

Hildebrand Contractors, a joint venture of J. A. Jones Construction Co., Charlotte, N.C., and Charles H. Tompkins Co., Washington, D. C., will complete the 3-yr. project in July, 1959. The lock will have a usable length of 600 feet, a width of 84 feet, and a lift of 21 feet. The dam will be 530 feet long and 70 feet high. These structures will replace two other locks and dams on the Monongahela.

To keep navigation flowing without interruption, the contractor is constructing the dam and lock in four stages behind cofferdams. Despite cramped working quarters and bad weather that held up progress for almost a full season, Hildebrand Contractors are on schedule.

Bucyrus-Erie excavators and cranes will keep your job on schedule, too. Get the facts from your Bucyrus-Erie distributor now.

465E58

Termed the busiest piece of equipment on the job, this 22-B Transit Crane handles a variety of jobs. These include loading and unloading trucks, hoisting forms into place, and handling steel and forms. The machine is equipped with a 65-ft. boom and 20-ft. jib. Defying steep grades, the 22-B moves quickly to scattered locations at the job site.

BUCYRUS ERIE

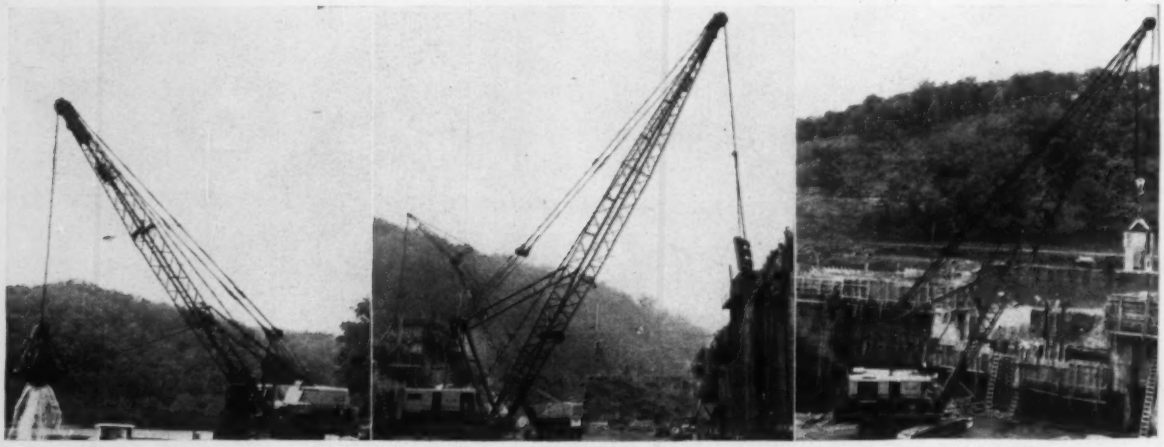
A Familiar Sign at Scenes of Progress

BUCYRUS-ERIE COMPANY • SOUTH MILWAUKEE, WISCONSIN

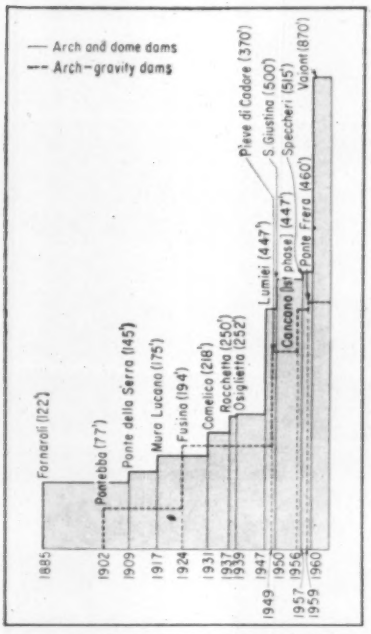
Two 38-Bs cooperate to excavate 4,000 yards of rock and 10,000 yards of common material for dam abutments. One 38-B excavates and loads material onto a barge for a trip across the river. The other, working on the opposite bank, unloads this material into end dumps for hauling to regular dump piles.

Team work is important on the Hildebrand contract. Here, the 54-B with 90-ft. boom sets forms and steel. When not pouring concrete, the 71-B works along with the 54-B on this job. Before it was assigned to this section of the work, the 54-B drove piles for cofferdams.

Like other equipment on the job, the 71-B does double duty. After excavating 300,000 yards of common material and 125,000 yards of rock, it pours the entire bulk concrete load of 130,000 cubic yards. Fitted with a 4-yd. bucket on a 90-ft. boom, the 71-B reaches easily to 65-ft. radius . . . works quickly and surely.



. . . The dams go higher, particularly arch types



ARCH AND ARCH GRAVITY DAMS in Italy have steadily increased in height, and particularly in the last decade.

being the same, 45%. Thus the profile of the buttress is a hollow isosceles triangle, and it is evident that the vertical component of the hydrostatic pressure contributes to stability to a much greater extent than in the earlier structures.

Ten dams of this type have been completed recently or are still under construction. Typical among these structures is Sabbione Dam (p. 48), built in 1949-53. It has a maximum height of 194 ft, and a crown length of 917 ft, made up of 795 ft of hollow elements, with the remaining 122 ft occupied by two massive walls.

And, finally, among Italian hollow buttress dams mention should be made of Ancipa in Sicily (p. 47), the highest yet built, 368 ft. I presume it is also the highest hollow structure in the world. Its crown length is 917 ft, and its volume 420,000 cu yd.

Extensive discussion has occurred among Italian engineers on the merits of the two main types of hollow dams. The far greater transverse resistance of the double-buttress type is often acknowledged, but nevertheless dams with independent elements also have been built quite recently.

The substantial economic advantages afforded by hollow dams in Italy, resulting from their relatively small concrete volume, already has been mentioned. From the technical point of view, an interesting advantage attributed to the hollow type is the practical absence of uplift while some engineers are inclined to stress the difficulties resulting from the different thermal behavior of different parts of the buttresses and the necessity—or at least advisability—of avoiding foundations with marked geological discontinuities or variations in elastic characteristics or ground morphology.

Model tests have helped, and will help further, to analyze the actual behavior of these structures.

• **Arch dams**—The development of arch dams, particularly the dome and arch-gravity types, can be classed as one of the most remarkable characteristics of Italian dambuilding in the last 20 years. The increase in the construction of these structures is indicated in the table of Italian dams, and the increase in their maximum height is charted on this page.

The growth of these arch dams, as already mentioned, is largely due to the geological and morphological features of some mountain regions, especially in the Northeastern Alps, and to economic reasons related to the reduced amount of concrete required. It also must be added that the choice of this type of dam is supported by consideration of the large resources of resistance in arch structures under exceptional loads. This fact has been known to Italian builders through century-long experience, and in recent years model tests, both static and dynamic (i.e. earthquake resistance tests) have confirmed the higher degree of resistance of arch dams in comparison with other types. Finally, arch dams seem to be particularly able to support both normal and exceptional loads, and are, therefore, far safer, on the whole, than gravity structures.

Arch dams are usually divided into three types: arch, arch-dome and arch-gravity.

Among the latest Italian arch structures is S. Giustina Dam on the Noce River north of Trento, which was completed in 1950 and is one of the highest arch dams in the world 500 ft. On page 50 it is compared to three of the highest arch dome dams, one of which, Vaiont, is being built to the unprecedented height of 865 ft. S. Giustina was built as a single-curvature arch, to accord with the shape of a gorge whose sides are almost vertical. Unusual difficulties had to be overcome because of the character of the rock.

Among the arch-dome structures, Osiglietta Dam (p. 50) was the first dam of this type, being built in 1937-39. It represents a considerable step in the technical field by virtue of the introduction in its construction of the "pulvino-perimetral joint" device. The "pulvino" is a sort of distribution saddle cast all along the ground surface that supports the dam, and is separated from the structure itself by a permanent "perimetral joint."

The first large dome structure built after World War II was Maina di Sauris Dam on the Lumici River, which was completed in 1947. A considerable height (435 ft), double curvature and reduced thickness give this dam a particularly slender profile (p. 50). The dome, perfectly symmetrical with respect to the middle axis, simply rests on the pulvino of the abutment (as in Osiglietta Dam) and on a small asymmetrical plug.

Several other arch-dome dams are worthy of note. Barrea Dam on the Sangro River is notable because its plug penetrates 100 ft into the underlying alluvial river bottom, as far as the end of the erosion gorge. Ponte Racli Dam on the Meduna is a slender structure, which is also remarkable for the depth of its narrow plug. Val Gallina Dam (p. 50) consists of a highly curved dome with a chord-height ratio of 3:1. Its symmetry with respect to the vertical plane also is attained through the adoption of a plug, and the abutment line of its dome has an ovoidal development and is delimited by a continuous perimetral joint. Finally, there is Barcis Dam, which is markedly asymmetrical in order to fit in with the morphology of the gorge.

Among arch-dome structures recently completed are Specchieri Dam (p. 50) on the Leno di Vallarsa, which is 506 ft high, and Ambiesta Dam (1956), remarkable because it was built in a particularly seismic area and thus was given a special shape, which was confirmed in extensive dynamic model tests at the ISMES Laboratory in Bergamo.

Vaiont Dam in the vicinity of Belluno, which is still under construction, will be the highest arch dam in the world, 870 ft (p. 50). It is a slender, double-curvature, slightly asymmetrical structure, designed to block a Dolomitic gorge of exceptional depth. The crest chord is nearly 560 ft long, and the dam's volume is 475,000 cu yd.

The first and perhaps still the most important arch-gravity dam is Pieve di Cadore, which was completed in 1949 (see photo p. 54). The partial discontinuity of the foundation of its arch is due to a deep side gorge, which has been blocked by means of a plug. The maximum height is 370 ft at the plug, the arch height being 180 ft. The crest length is 1,350 ft, and the total volume 500,000 cu yd. Thicknesses are: 19.7 ft at the top, 85 ft at the arch base and 115 ft at the base of the plug.

Characteristic features of this dam are a chord-height ratio in the arch proper, which exceeds 5.5, and a ratio of arch crown length to height, which reaches 7.5. The studies and investigations car-

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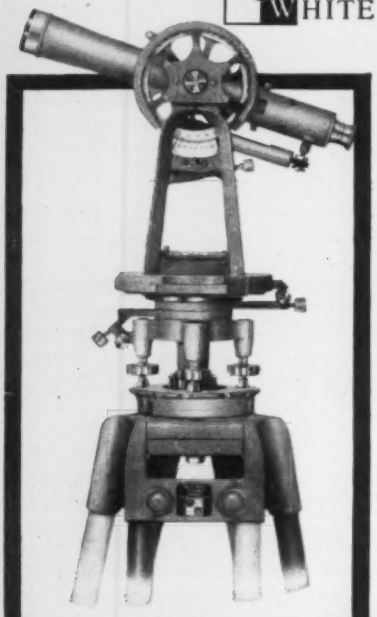

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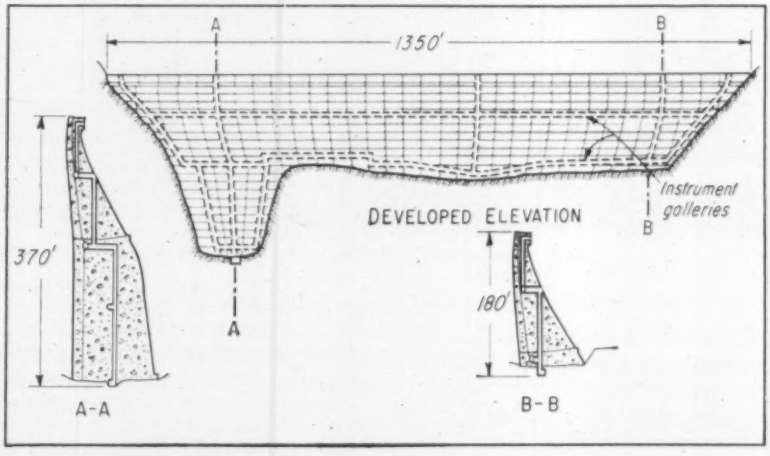
. . . Instrumentation of dams checks their performance

ARCH-GRAVITY DAMS in Italy were nearly doubled in height when Pieve di Cadore, shown here, was completed in 1949. It is 1,350 ft long and 370 ft high.



PIEVE DI CADORE DAM in the Dolomites is notable for the large number of instruments installed in galleries in its arch-gravity section for studying its behavior.

ried out for this structure, along with the results of an extensive network of over 800 gaging and control instruments installed in the dam itself, make it a real achievement in the field of technical development as well as a prospective source of information for future refinement of dam designs.

Other important arch-gravity structures were completed soon after Pieve di Cadore was finished. Among these are Cecita Dam on the Mucone River (1949-1951), built on partly decayed granite, Publino (1950-51), Fiastrone (1950-52), Travignolo (1950-52), remarkable for its substantial dissymmetry, and Beauregard and Flumendosa (1957). Beauregard is 435 ft high, 1,340 ft long at the crest and has a volume of 565,000 cu yd. Flumendosa Dam is an important achievement in the development plan of Sardinia.

Of a particular interest, also, are the solutions adopted for the building in two stages of Cancano II and Frera Dams, two large arch-gravity structures in Lombardia. Cancano, which reached a height of 433 ft in the first stage with a volume of 673,600 cu yd, will be 564 ft high with a volume of 1,438,800 cu yd in the second stage. Frera will be 240 ft high in the first stage, reaching a height of 453 ft and a volume of 562,000 cu yd in the second stage.

With respect to arch dams in general, it is evident that their field of application has constantly been widening in the last 20 years, and still tends to enlarge, perhaps at a higher rate than that of other types of dams. Until a few years ago it was regarded as necessary to have a rocky foundation of particular compactness and impermeability, with a rather high and uniform young modulus. Today it is possible to give the ground properties it did not have before, and thus improve its characteristics. Furthermore, it is admitted that in an arch dam a com-

(*Continued on page 58*)

all these

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find application in dam construction

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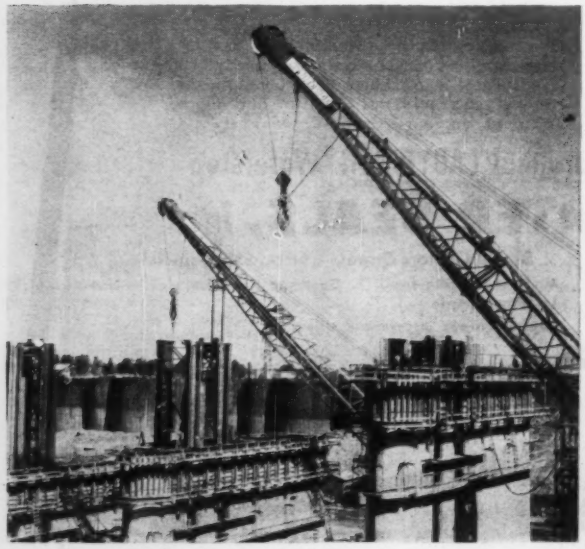
1 **MR. WIRE ROPE**—Ed Carey (right), Tiger Brand Wire Rope sales representative, is known as "Mr. Wire Rope" on the St. Lawrence Seaway & Power Projects. Ed is checking sheave grooves on a walking dragline with Mr. Mel Poeschl, Equipment Superintendent for Waddington Constructors, combine composed of Kiewit, Morrison-Knudsen.

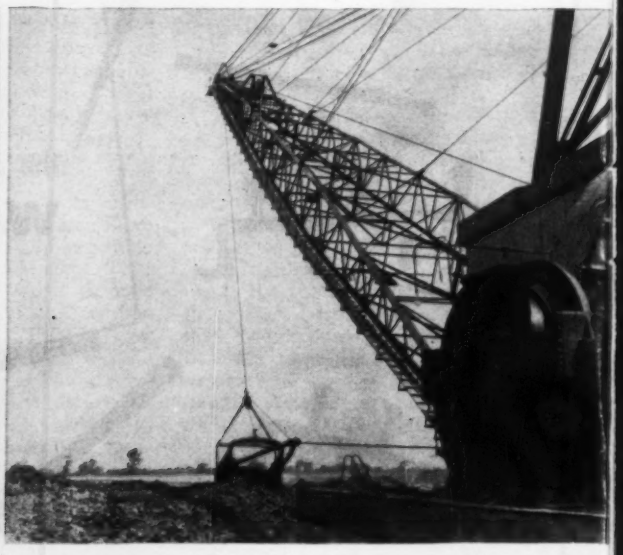
2 **GRASSE RIVER LOCK**, St. Lawrence Seaway. Gantry cranes rigged with 7/8" 6x19 Tiger Brand Hoist Ropes are pouring a total of 376,000 cu. yds. of concrete. This lock is one of two which will provide for raising and lowering vessels to and from the lake created by the Barnhart power dam and the Long Sault spillway dam. General Contractors: Joint venture between Perini, Walsh, Kiewit, Morrison-Knudsen and Utah.

Tiger Brand Wire Rope makes things hum

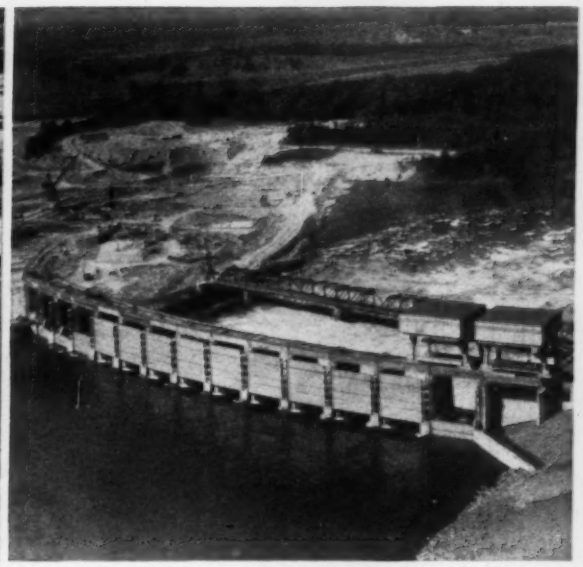
5 **IROQUOIS DAM**, New York State Power Project. Located 25 miles upstream from Long Sault Dam. This dam is to control and regulate the outflow from Lake Ontario. Cranes are equipped with 1 1/8" 18x7 Tiger Brand Non-rotating Hoist Rope. General Contractors: Joint venture between Kiewit, Johnson, Johnson.



6 **LONG SAULT CANAL**, mainland portion, St. Lawrence Seaway. Monighan dragline with 13-cu.-yd. bucket equipped throughout with Tiger Brand Wire Rope. The drag rope is 2 1/8" 6x19 Excellay Monitor Lang Lay IWRC. This job involves digging 12,000,000 cu. yds. of heavy marine clay and cemented glacial till, two of the most tricky and unpredictable materials you can find. General Contractors: Joint venture between Kiewit, Morrison-Knudsen.

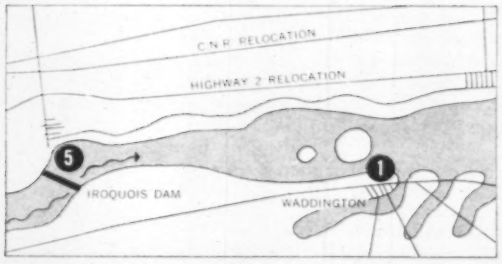


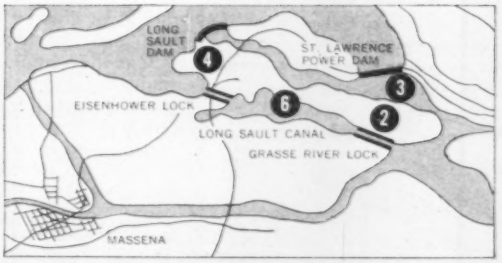
3 **ST. LAWRENCE POWER DAM,** New York State Power Project. Photo shows U. S. Section. Combined Canadian and American power houses will produce 1,880,000 kilowatts, half to each nation. Whirly cranes erecting forms and pouring concrete are rigged with Tiger Brand 7/8" 6x19 Hoist Rope Excellay Monitor IWRC. General Contractors: Joint venture between Perini, Walsh, Morrison-Knudsen, Kiewit, Utah.



4 **LONG SAULT SPILLWAY DAM, FIRST SECTION,** New York State Power Project. This dam controls the flow of water into the power pool and thence to the power dam. At present all of the St. Lawrence flows through this section. General Contractors: Joint venture between Walsh, Perini, Morrison-Knudsen, Kiewit, Utah.

on St. Lawrence Seaway and Power Projects





This is the big year on the St. Lawrence Seaway and Power Projects. Contractors are rushing to complete their jobs on time. Everywhere you look, big shovels and draglines are digging 24 hours a day. Huge gantry cranes are setting forms and pouring concrete. The St. Lawrence River has been moved so many times it doesn't know its own bed.

All this adds up to a situation that demands the most from machines and wire rope . . . and most of the wire rope on the American jobs is Tiger Brand.

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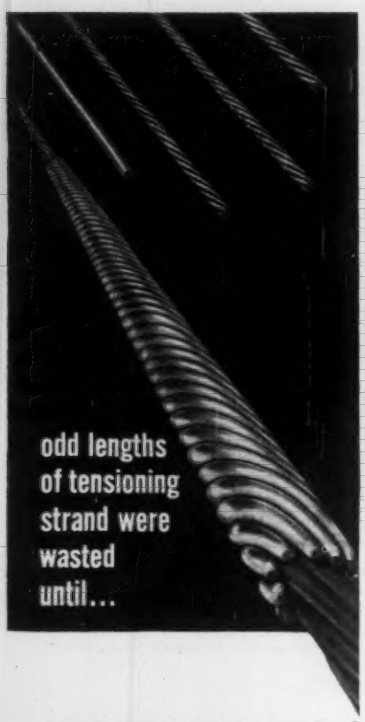

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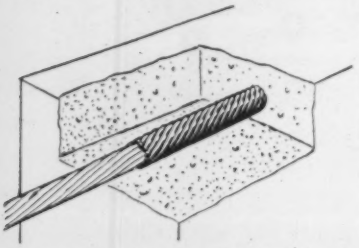

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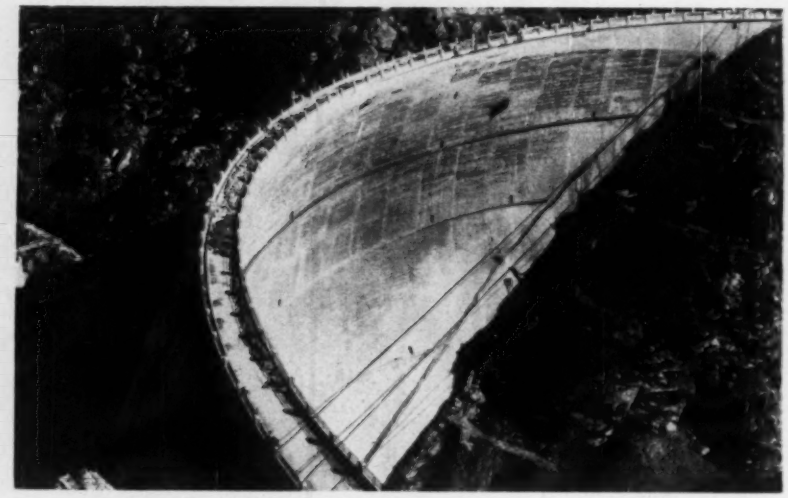
. . . Flood flows can spill from the arch dam's crest



FOR SARDINIA'S DEVELOPMENT, Flumendosa Dam will provide one of several new reservoirs. Of arch-gravity type, it is 390 ft high, 960 ft long and contains 415,000 cu yd.

paratively yielding foundation may be even more favorable than a rigid one.

Arch and arch-gravity dams are also built now in locations where the ratio between transverse and vertical dimensions is remarkably high. Osiglietta Dam has a chord-height ratio of 2.3:1, which would hardly have been permitted a few years before it was built. Yet the ratios used today are far higher.

Both symmetrical and asymmetrical arch structures have been adopted in Italy, according to the morphological conditions. Now, some Italian engineers believe that these structures should be studied with a view to enabling their geometrical parameters as well as their supporting surfaces to vary gradually. Supporting surfaces are no longer designed as a succession of steps, but as continuous surfaces, despite increase in excavation.

Finally, to obtain a better structual continuity of the abutments, the "pulvinoperimetral joint" system has been adopted by many engineers in our country. Some characteristics of this system already have been mentioned, and I would only add that the pulvino is apt to assume predetermined statical functions in relation to the rock contour features. Model tests carried out in this connection have underlined the usefulness of the device for reducing upstream tensions and for avoiding discontinuity in the development of the stresses. It also should be noted that this device permits the seperation of the part of the structure inevitably bound to the rock from the one which has to work—as far as possible—independently of it. This is of special importance from the thermal viewpoint.

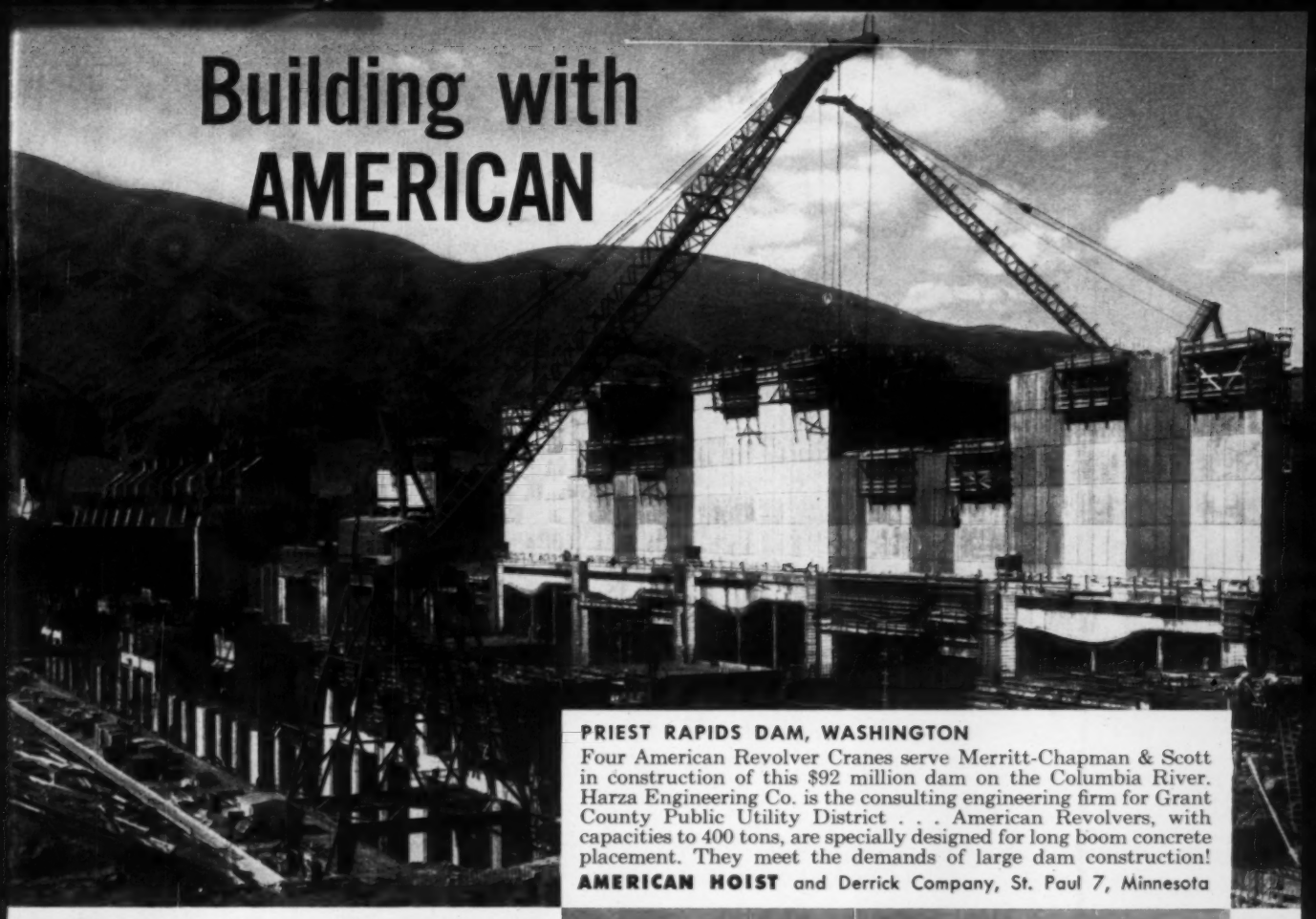
With regard to flood discharge, it is commonly admitted that, in case of exceptional floods, arch dams in a firm rock bed can safely be overflowed by the "peak" of the flood diagram, with base discharge being carried by the other outlets.

Concerning model tests, I would emphasize again the extensive development of large-scale testing that occurred in Italy. Nearly all the arch structures built in the last 20 years have been subjected to model tests, mostly at the ISMES Laboratory in Bergamo, which is fitted for large dam models.

These experiments have contributed validly to the study of new structures, especially of the dome and arch-gravity types, where the complex stress distribution was made synthetically clear. It is impossible, of course, to obtain an absolutely exact quantitative determination of the stresses either through analysis or model tests. Yet the constant refinement of investigational methods, and above all, the progressive control on the actual behavior of the constructed dams—which in our view is fundamental—should enable us gradually to undertake further revision of the criteria that have been up to now adopted in the designing of dams. This revision will result in a further refinement of the various types of dams without prejudicing their safety, which must, of course, be given first consideration. Our aim is simply to place concrete where it is actually required.

I wish to thank Messrs. Sensidoni, Scalabrini and Testa, whose suggestions were very helpful to me, as well as all the people who supplied me with the data for the statistical survey, which was carried out expressly for this article. Special mention should also be made of Mr. Ennio Gallo, who assisted me in drawing up these notes.

Building with AMERICAN



PRIEST RAPIDS DAM, WASHINGTON

Four American Revolver Cranes serve Merritt-Chapman & Scott in construction of this $92 million dam on the Columbia River. Harza Engineering Co. is the consulting engineering firm for Grant County Public Utility District . . . American Revolvers, with capacities to 400 tons, are specially designed for long boom concrete placement. They meet the demands of large dam construction!

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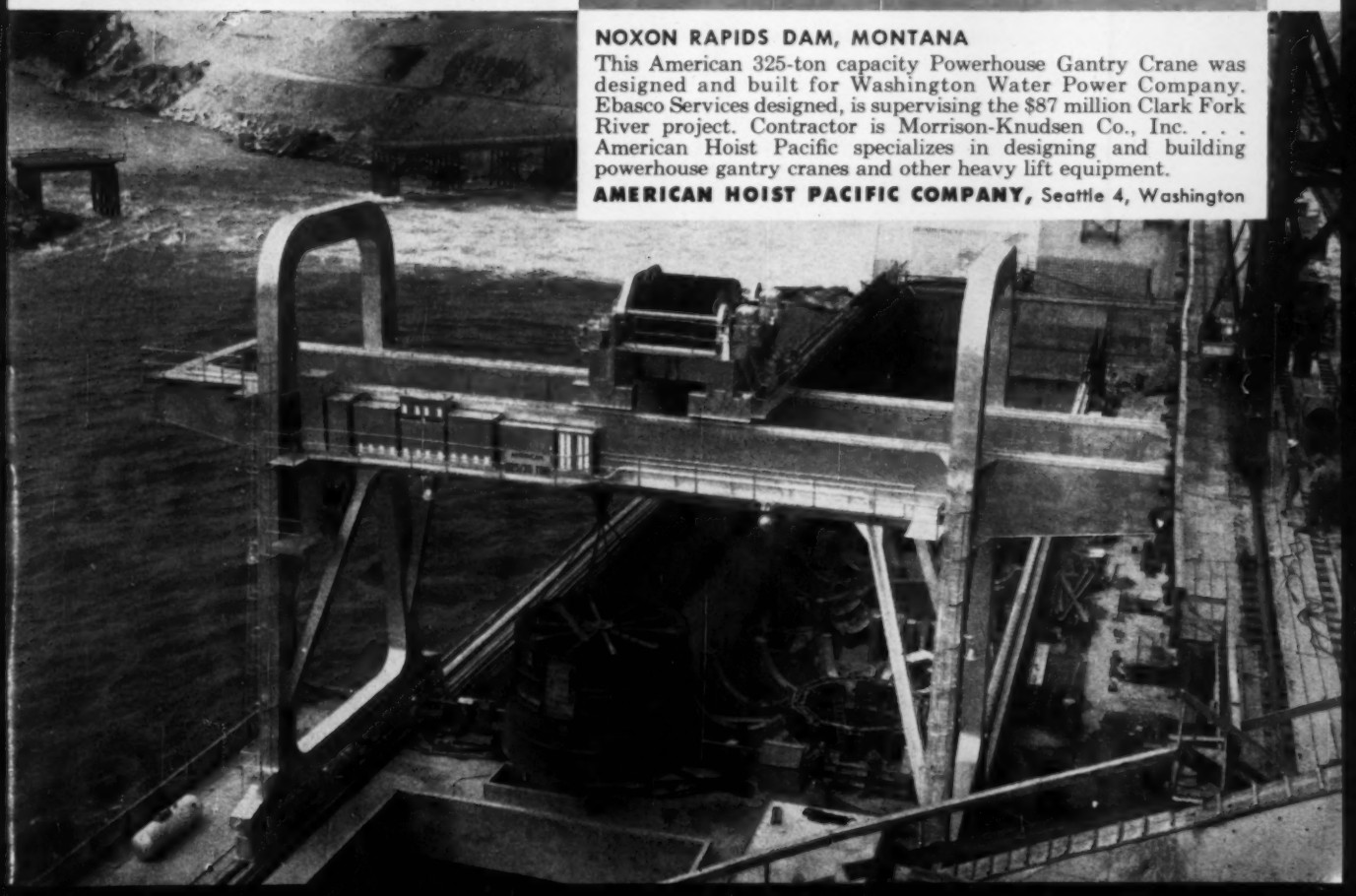
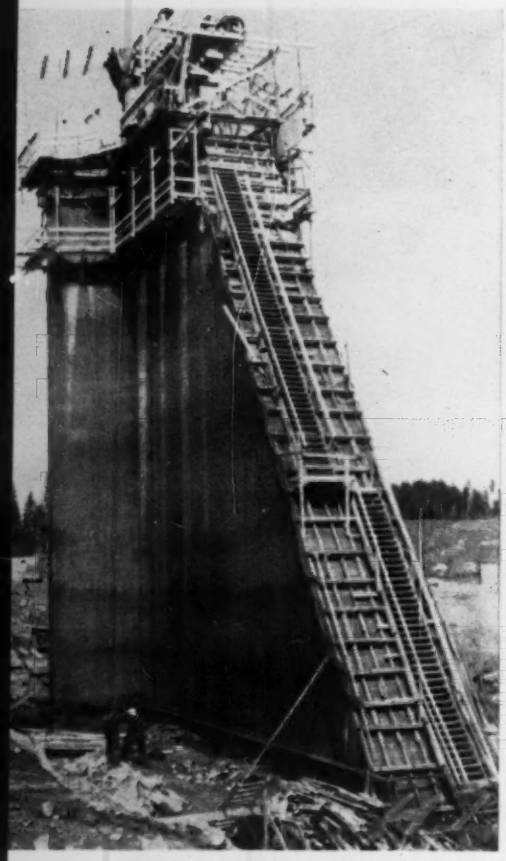


NOXON RAPIDS DAM, MONTANA

This American 325-ton capacity Powerhouse Gantry Crane was designed and built for Washington Water Power Company. Ebasco Services designed, is supervising the $87 million Clark Fork River project. Contractor is Morrison-Knudsen Co., Inc. . . . American Hoist Pacific specializes in designing and building powerhouse gantry cranes and other heavy lift equipment.

AMERICAN HOIST PACIFIC COMPANY, Seattle 4, Washington



SLIDING FORMS for all vertical faces have speeded the construction of buttresses.

SWEDISH EARTHFILL DAMS are compacted by a "wet-fill" method in which the moistured content can be near the liquid limit of the material. Wet weather doesn't matter.

Better, Bigger Dams—

The Swedish Contribution

Tore Nilsson
Director, Civil Engineering Department,
Swedish State Power Board

In Sweden sizable dams are constructed for hydro-power purposes only. The characteristics of the topography and of the Swedish watercourses in wide flat valleys, as well as the Swedish methods of development, are such that very large dams seldom need to be considered.

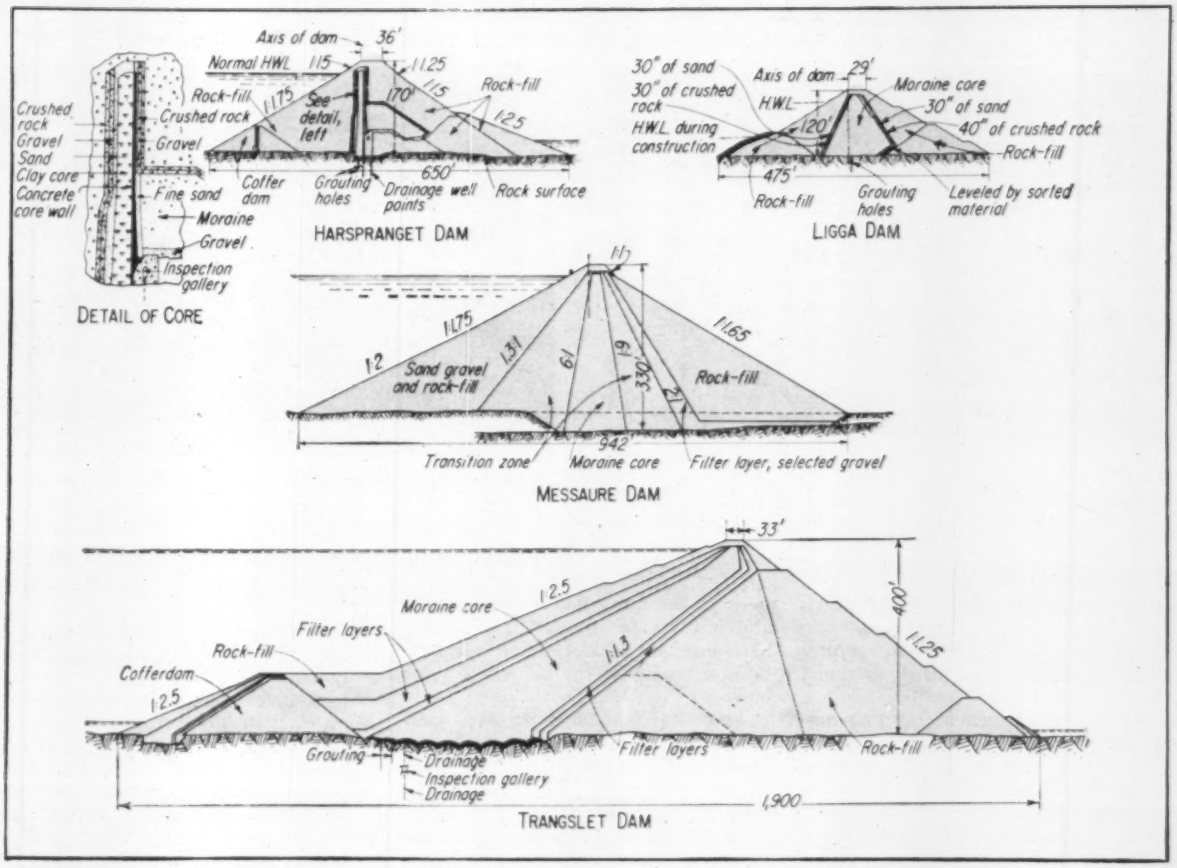
Large storage reservoirs are usually obtained by moderate regulation of the levels in the big lakes that exist in the upper catchment area of the rivers. Thus, the current practice is to develop the head for power stations by means of tunnels and canals in conjunction with dams of moderate height. But the sparsity of giant Swedish dams notwithstanding, there is an ambition manifested in Sweden to advance the technique of dam construction and to adapt it to Swedish construction conditions.

Dam construction in Sweden is so apportioned that about half of it is done by municipal and private enterprises and half by the national government through the Swedish State Power Board. The Board designs its dams and builds them with its own forces.

• **Concrete dams**—The water in Swedish rivers generally has a pH value of 6 to 7, which implies that in a relatively short time it can affect the lime in the hydrated cement. Hence, concrete exposed to percolating water gradually will be destroyed. This fact has had to be taken into account by Swedish dam engineers by appropirate design and efficient construction.

In Sweden the conventional gravity dam is not used very often, greater preference being given to other types such as the buttress. The endeavor is to provide ventilation, even with hot air, on the air side of the structure, with the hope that any ensuing deposit of lime will tend to tighten smaller cracks.

Watertightness of the concrete is generally held to be the factor of primary importance, rather than strength, but depending on the quality of the aggregates, satisfactory strength and watertightness usually are obtained with a cement content of 450-600 lb per cu yd. Watertightness of the concrete itself is mainly a result of appropriate proportioning to give the mix good workability, consistency and homogeneity. It was to attain these qualities that the engineers of the Swedish State Power Board introduced and put into regular use an air-entraining agent of the albuminous type as early as 1937. The aim is to obtain a concrete with an air content of 4 to 5% by volume. Such a concrete will have the frost resistance necessary in the generally hard climate of Sweden. In addition,



SECTIONS of recent rockfill dams illustrate Swedish practice in utilizing moraine for cores and the blasted rock from tunnel and power plant excavations for fill. Abundance of the glacial moraine, an excellent core material, makes rockfills very popular.

in many cases, the use of air-entraining agents permits a reduction of the cement content, reducing the reaction heat and consequently the risk of cracks.

Also, with a view to reducing heat generation, and thereby frequency and width of cracks, a special low-heat cement—of about the same type as ASTM Type IV, but a little coarser—has been employed in hydraulic structures. It has been manufactured specially for this purpose on the demand of the State Power Board since 1932.

It has been found that the formation of cracks is less than would be supposed for the wide variations of temperature to which the concrete structures are exposed. In order to explain this fact, the qualities of frozen concrete were investigated, and it was found that the extensibility of frozen concrete is about double that of unfrozen concrete.

As a rule Swedish technique aims to avoid joints in concrete as far as possible. Thus it is not uncommon practice to place concrete continuously to heights up to 65 ft.

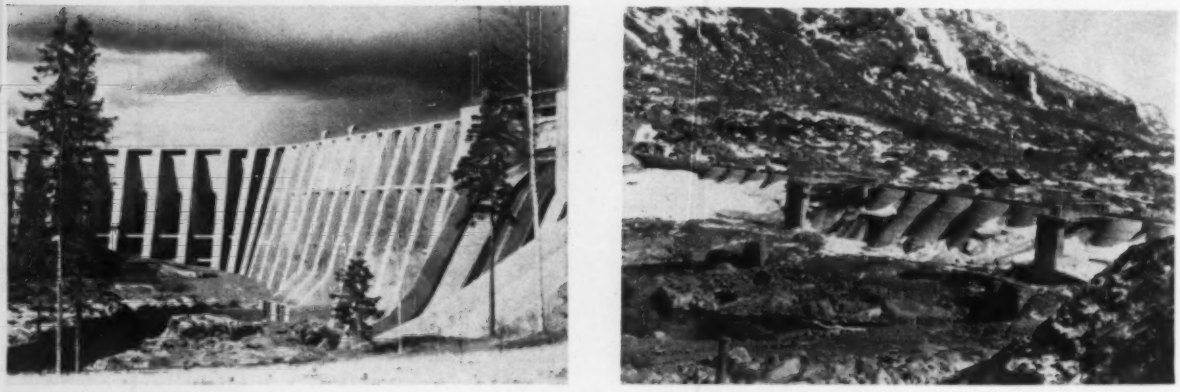
How Swedish engineers have met these particular problems of concrete dams may be illustrated by citing a few actual structures.

The dam at Stadsforsen power station, built during the years 1936-1939, consists of two distinct elements: the main gravity section or load carrying element and an upstream slab face for watertightness, with an air space between the two. The main dam portion was made of poor concrete (330 lb of cement per cu yd), while the slab was strongly reinforced and cast of the best quality concrete (580 lb of cement per cu yd). It was designed so that cracks, in so far as possible, would not occur, and it has proved to be tight and dry on the air side. The space between the dam and the slab not only facilititates inspection and maintenance, but, of equal importance, it provides ventilation on the air side of the slab.

At Krangede (1934-1936) and at Storfinnforsen (1954) buttress type dams were chosen in perefernce to gravity designs. Krangede is 80 ft high Storfinnforsen 100 ft. And presently under construction is another 80 ft high buttress-type-dam at Langbjorn, notable for its use of sliding forms on all except the sloping downstream face of the buttresses. This method saves a lot of time and effects a considerable cost reduction. A complete 80 ft high buttress is cast in 10 days as against the

LOCATIONS of some of Sweden's technologically notable dams.

. . . Sweden's dams, concrete, earthfill or rockfill, are all influenced in their



MOST CONCRETE DAMS in Sweden are of the buttress type, generally of the slab and buttress variety as at Storfinnforsen (left), but a multiple arch has been in service for some years at Suorva (right).

three months previously required.

At Krokstrommen (1952-1954) conditions favored construction of an arch dam, 160 ft high. Extensive measurements have been made to control stresses as well as eventual structural changes.

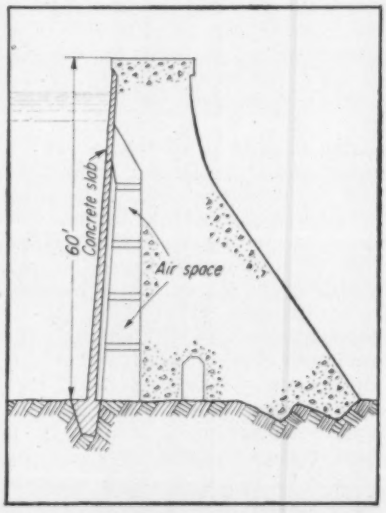
Finally, it is worth noting that during the years 1919 to 1923 a multiple arch dam of thirty-four 40 ft span arches was constructed at Suorva in the mountainous regions about 80 miles north of the Arctic Circle. Of 50 ft maximum height, the dam was designed for a future increase in height of 35 ft, and this was done in 1939-1942. This first dam was made of good concrete (540 lb of cement per cu yd). However, since too little vertical reinforecement was used, cracks appeared in the lower parts, and deterioration of the concrete has begun. The need to replace this dam with a new structure probably will become urgent 10 to 15 years from now. The type of dam likely to be chosen then is a rockfill dam with a moraine core. This can be considered characteristic of the trend in modern Swedish dam technique.

• **Earth and rockfill dams**—As a left-over from the glacial period, moraine can be found in many places in Sweden. Since it can be an excellent material for the impervious cores of earthfill and rockfill dams, Swedish engineers have had a special incentive to study means for its effective use.

In most countries of the world, the compaction of earth is usually done according to the rolled-fill (Proctor) method. In Sweden, however, as the moisture of the natural moraine is often high, and precipitation is common during the short work season, it is generally difficult to keep the water content of the material down to the requisite optimum degree during the compaction. The State Power Board has, therefore, developed the so-called "wet-fill method", based on thorough investigations of the properties of the moraines at different water contents. The method has important advantages in construction, in quality of the fill and in economy.

The wet-fill method involves compaction of the moraine at a water content near the liquid limit of the material, or considerably higher than for the rolled-fill method. Such a high water content is possible, however, only when the moraine does not have too high a clay content, and is therefore reasonably permeable.

From the construction point of view, work seldom has to be stopped by rainy weather when the wet-fill method is used. Also, the work is independent of the moisture of the moraine in the pit. Bigger sizes of stones may be tolerated, and the compaction can be simplified to include only a small amount of work by heavy tractors. Control is also simpler since no continuous checking of the weight per unit of volume is required. Although it is important for the material to possess the correct water content, it is, however, much easier to see when the moisture of the material is not right than it is with the rolled-fill method.



WATERTIGHTNESS of this dam at Stadforsen has been assured by an upstream slab of dense concrete separated from the main body of the dam by an air space.

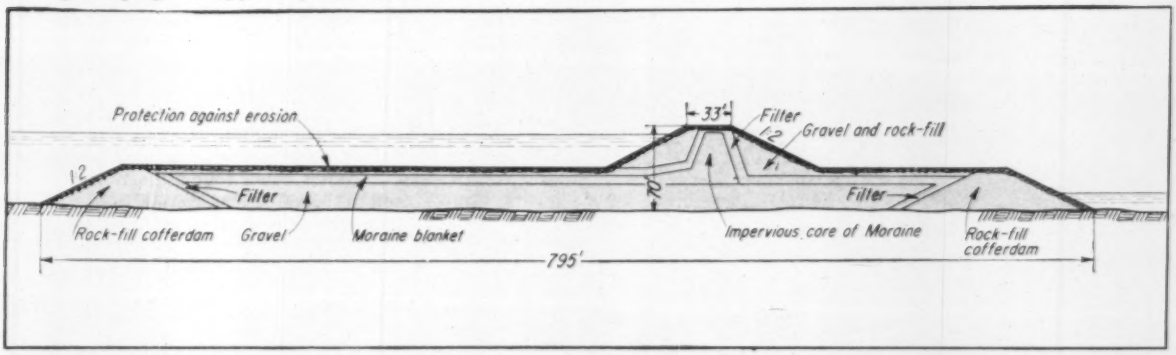
During construction, the weight per unit of volume will be less than that obtained with the rolled-fill method, but as the consolidation proceeds the volume weight increases to 95 to 98% of the maximum Proctor volume weight. This also causes an increase of the internal friction angle, which reaches 45 to 50 deg.

In the wet-fill method the settlements are greater than with the rolled-fill method. Nevertheless, the material consolidates rapidly, so that when the dam is completed and exposed to water pressure there will be very little further settlement. The pore pressure is at first 100%, but decreases rapidly so that full consolidation is obtained in from six months to a year. It is also to be noted that whereas even small variations in compaction will greatly influence the permeability of a rolled-fill this is not at all the case with a wet-fill core.

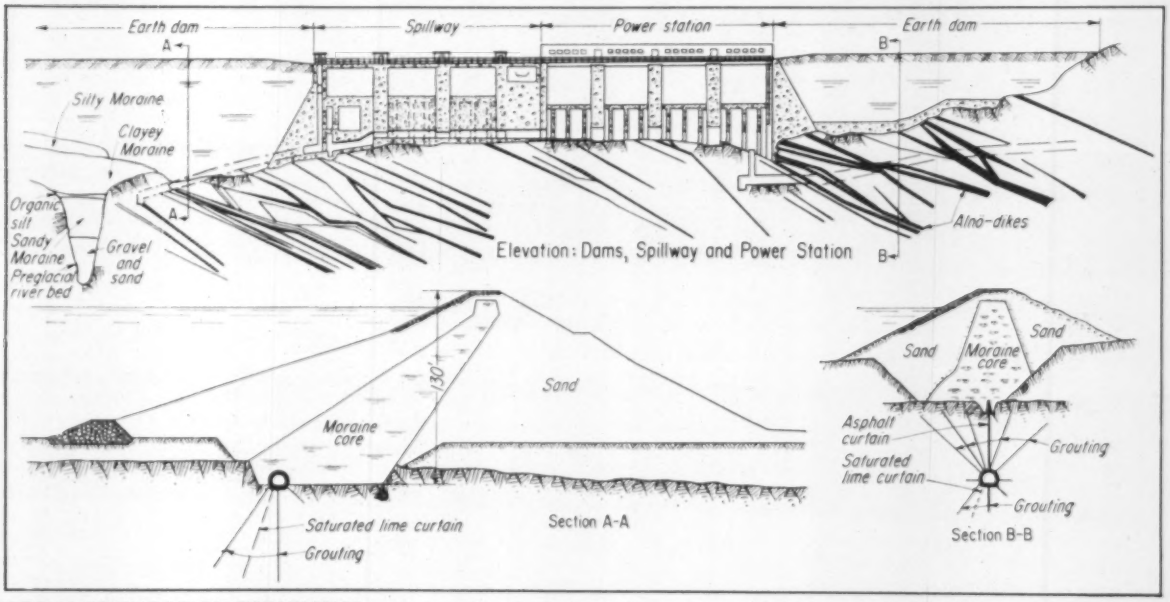
The wet-fill method has been successfully applied during the last seven years in all earth and rockfill dams built by the State Power Board, and also in a number of private dams.

Where moraine or any other impervious earth is not available in the required quantity, watertightness has been produced by means of a reinforced concrete core with a thin earth layer on the upstream side. The core is made very thin and so designed that, without too much cracking, it may follow the possible deformations that will arise due to the movements in the supporting fill. One

design by geology, topography and climate of their northern location



LONG CROSS SECTION was used for Jarkvissle Dam to take account of permeable foundations. Long blanket extension of moraine core extends entirely across dam.



SPECIAL FOUNDATION TREATMENT was required at Bergeforsen Dam to prevent washing out of magma lenses. Injection of lime water and asphalt are being used, applied from grouting tunnels.

example of this type of dam has a core made of wood in three crossing layers of 4 in. planks. The function of the core in any case is merely to serve as an extra safeguard during the time before the dam has stabilized and the tightening by the earth itself becomes effective.

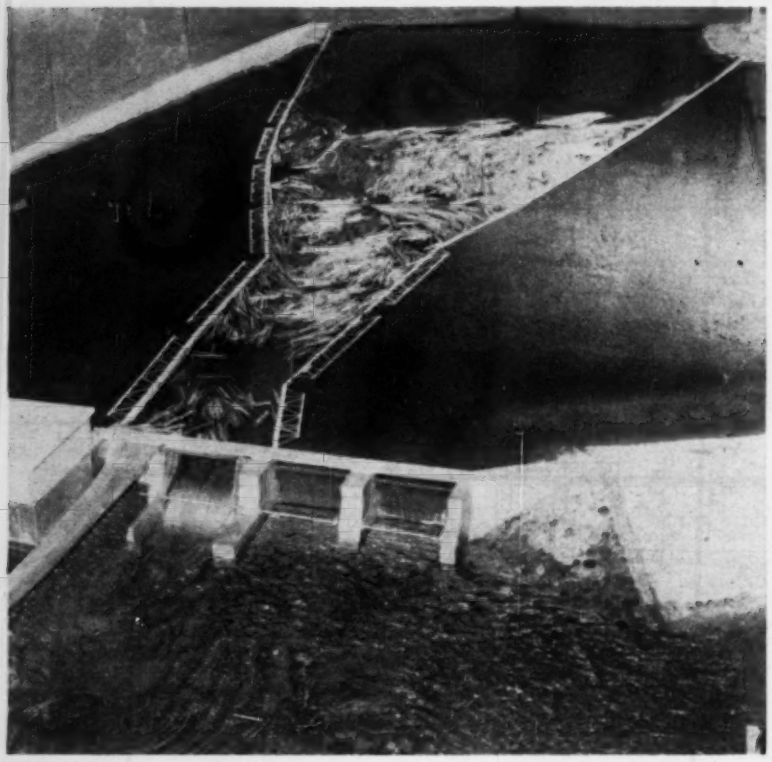
Among Swedish earth and rockfill dams worthy of note is a 60 ft high earth embankment built at Porjus between 1910 and 1915. It was provided with a relatively ample concrete core on whose water side was placed a puddled core of sand mixed with clay. In 1939, the dam was raised about 7 ft. During all this time it has been tight and has required no maintenance. Cracks are likely to have occurred in the concrete core, but if so, the clay fill has acted as a sealing agent. It has also prevented percolation and consequent deterioration of the concrete.

The dam at the great Harspranget power project (1946-1951) is a 170 ft high rockfill for which material was obtained from the excavation for the power station and its tailrace tunnel. The rockfill was spread in rather thin layers (20 to 40 in.), which were rolled and flushed with water during the summer. The core consists of a thin (16 in.) concrete slab, heavily reinforced and with no expansion joints. It is designed to resist possible deformations without concentrated cracks. On the water side of the slab there is a layer of clay mixed with sand. Together the concrete and the clay form an exceedingly safe and impervious structure. The design, an improvement on the Porjus dam type, has been used in a number of other Swedish dams.

Another more recent rockfill dam (1953) was built at Ligga, six miles downstream from Harspranget. It is about 120 ft high, and its central core is made up of moraine material. Again, the rockfill was supplied from the power station excavation.

But it is in the middle of Sweden at Trangslet that the largest rockfill dam is under way. Being constructed by a private company, it will be 400 ft high and have an inclined impervious core of moraine. Its total volume will be 9.6 million cu yd. Only a minor part of the filling material is being obtained from the power station and tunnel excavation as compared to that taken from a separate borrowpit. The construction schedule has had to be fitted to the necessity of floating timber through the site during every summer, so that the dam will not be completed until 1961.

Another high (330 ft) and larger (14 million cu yd) dam is under construction by the State Power Board as a part of the Messaure project, 25 miles down-



LOG FLUMES, required to pass pulpwood by dams, are studied in hydraulic models. The passage of logs can be a problem during construction as well as after.

stream of Ligga and just above the Arctic Circle. It is a combination earth and rockfill. The right bank of the river is covered with a sedimentary deposit of silt and gravel to a depth of 200 ft and, since it was deemed necessary to found the dam on rock, a considerable excavation job will be required to clean off bedrock.

The orientation of the dam was affected by the existence of some fault zones, indicating poor rock quality on the left river bank. This led to the construction of a canal downstream from the spillway, and it is the material from this canal that is being used as the fill for the dam. The fill on the upstream side of the dam is partly derived from the excavation on the right bank. The dam contains a central core of moraine. During construction the water is led through a diversion tunnel, since floating timber is not a problem. The work was started in 1957, and the dam is expected to be completed in 1963.

The dam at the Jarkvissle plant (1958) is unusual in that it is founded on permeable ground. Although it was not economically feasible to drain the riverbed, embankments of rock blastings could be placed to cut off the water flow. Then after cleaning the bottom of coarse material, selected gravel was filled in to just above the water surface. The filling was required to have about the same permeability as the ground beneath. On the top of the gravel the impervious part of the dam was built, involving a vertical core and a moraine blanket long enough to assure a safe gradient.

• **A special foundation problem**—In general, conditions for foundation work on Swedish dams are comparatively favorable. However, there are many exceptions to this rule, and the 100 ft high Bergeforsen dam and power plant, completed in 1955, is one. As shown by the longitudinal section there is a preglacial riverbed in the rock 170 ft deep. It is filled with gravel and sand and covered with moraine upon which the dam is founded. The deep furrow occasioned no unusual problems, but this was not the case for the ground to the right of it, which is traversed by a great number of so-called "Alno-dikes". The dikes, which are up to 7 ft thick, consist of a great number of intricate compounds, which as a rule contain calcium-carbonate and free carbon dioxide, the latter formed in microscopic bubbles under high pressure. In its "healthy" condition the material is hard like the surrounding rock, but some of it decomposes quickly on contact with water or with air and water as was discovered after construction was under way. The material became weak like clay and cavities appeared, which required emergency measures.

The dikes, it was deduced, were formed millions of years ago as a result of underground eruptions having their center about four miles from the damsite at a depth of about four miles under the surface. The upheavals caused the spread of a system of cracks in the rock, which assumed the shape of funnels with their points in the eruption center. The cracks were filled with magma from the interior of the earth. This magma later solidified and formed the Alno-dikes. Similar formations are known to exist in only a few places—the Kola peninsula of the USSR, in Scandinavia, and at Kimberley in South Africa. In Kimberley, the dikes contain diamonds, for which we unfortunately looked in vain at Bergeforsen.

To prevent the washing out of the dikes, extensive measures were instituted, starting from an inspection passage—partly tunnels—below the dam. From this gallery, drilling, washing and cement injections were carried out to create a tight curtain 70 ft deep. Then, in front of this curtain, another curtain was produced with a somewhat lesser degree of tightness. In between these curtains a row of holes was drilled, in which saturated lime water was injected at a pressure somewhat higher than the water pressure on the upstream side of the dam. The result is that the water leaking beneath the dam toward the downstream side consists of saturated lime water, which does not attack the material in the dikes, and which, we hope, will help to seal them. The lime water consumption is at present 8,100 gal per 24 hour period. It is expected that these lime water injections will have to be continued for several years to come.

The connecting dam to the right was completed at an early stage of the work, and the inspection tunnel there had to be blasted out subsequent to the completion of the dam. Since it was difficult and risky to create an effective impervious zone between the tunnel and the rock surface by means of injections, the tight curtain here was accomplished with the tunnel as starting point. A row of closely spaced vertical holes was drilled up toward a concrete cut-off wall in the bottom of the earthdam. This curtain of holes was then filled with asphalt under pressure, and asphalt is continuously fed in. The demand for asphalt is at present averaging about 20 gal per week.

• **Special problems**—In Sweden, dam design and construction have to take into consideration two special problems

HOW TO HANDLE WET JOBS

#38 of a Series

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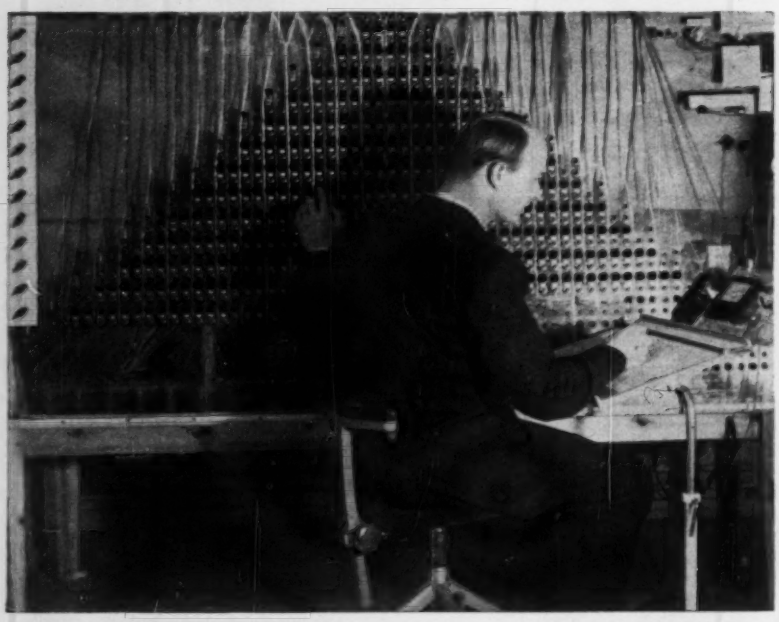
. . . Logs, fish and esthetics shape Swedish designs



SOLVING EARTH DAM PROBLEMS by electrical analogy is part of Swedish dam technique. This apparatus consists of a resistance network made up of capacitors.

–floating logs and protection of fish–which also are encountered in a few other countries. Swedish water courses in the northern part of the country, where most of the larger dams are built, are generally used for floating timber and pulp wood from the forests to the industries on the seashore. The length of the floating material varies from 10 to 27 ft, and as many as 20 million logs may be moved annually.

Specially designed log flumes are necessary to conduct the floating material past the dams. These flumes, as well as such openings in a dam as spillways and power station intakes, must be planned carefully so that the logs do not tangle up into a jam. It is also very important that the logs themselves are not damaged. When the river is diverted past the damsite, the same problem in a somewhat different aspect must be faced. Then a choice must be made among an open canal, a diversion tunnel with a free water surface or a separate tunnel for the logs.

Though seemingly a subordinate matter, the question of the influence of dam construction on the life of salmon and their breeding habits ranks high in importance among dambuilders. Since most of the Baltic Sea salmon spawn in the Swedish rivers now under development for water power purposes, it has been recognized that something must be done to avoid damage to the salmon fishing industry. Intensive research work, therefore, has been carried out jointly by the fishery authorities and the state and private dambuilders. It has been concluded that it is biologically and technically possible to maintain the stock of salmon through breeding and putting out smolt in sizes from five to six inches. By this procedure salmon fishing in the sea (which is twice as great as in the rivers) may be kept up, while fishing in the rivers will have to be abandoned.

Extensive experiments have been made with various breeding methods to reduce the cost, and with marking of smolt to determine how many return and are caught as adult salmon. In the last 10 years, about 300,000 smolts have been marked, with the recatchings running at a rate of about 10%. The relation between the cost and the usefulness of this procedure is such as to inspire a hope that it will actually turn out to be profitable.

• **Other considerations**—There are a number of other activities contributing to modern Swedish dam technique, which are worth mentioning. For example, to solve certain calculation problems on earthdams we have used an electrical analogy apparatus. It consists of about 400 capacitors, connected in an electric resistance network. The equipment can be used for solving non-stationary two-dimensional flow problems, consolidation processes in foundations and earthdams during and after construction and changes of pore-pressure during reservoir filling and drawdown.

Hydraulic model tests also are carried out for practically every Swedish dam. They have been used to solve the log floating question as well as for flow problems connected with intakes and spillways. Suitable arrangements for the completed plant as well as for the construction stages also are tried out by means of models.

After completion, all major Swedish dams are subjected to continuous control by experts through frequently recurring inspections, and through continuous measurements of all factors that may indicate eventual changes in the dams. Such a program of measurements is considered absolutely essential if the design and construction of dams are to be carried out in the most economical manner and with the necessary assurance of safety.

Finally, modern dam construction work occasions enormous changes in nature, so that it should be a point of honor for us to shape our structures in such a way that they fit into their natural environment and make an esthetic impression. In Sweden we are nowadays giving this matter a lot of careful attention. It is true that values of beauty are destroyed when natural waterfalls are inundated, but properly built dams in turn offer new architectural values of high distinction.

• **Costs**—Not only have dam construction techniques advanced very rapidly, but the advance has brought lower costs. The costs of the dams at Harspranget, Ligga and Messaure, situated on the same river and in close proximity to each other, illustrate this reduction. Harspranget's construction was under way from 1946-1951, Ligga from 1951-1954, and it is estimated Messaure's construction will occupy the years 1957-1963. The average costs per cubic meter are 10, 8 and 5 crowns, respectively, the last figure being the present estimate. The real differences are, as a matter of fact, still bigger because of the drop in the purchasing value of money.

This lowering cost trend is due both to improved design and to more efficient construction methods, the latter being largely based on the use of big and effective machines and the knack of operating them correctly. In Sweden the latest developments have brought the realization that earth and rockfill dams more frequently turn out to be cheaper than concrete dams. Partly this is a result of conditions of nature, but it is also a product of construction techniques. Thus blasting methods have been highly developed, and as a result the power stations are often constructed underground and tunnels used as water conduits. Moreover, it is economical to use rock from the blasting operations as filling material in the dam.

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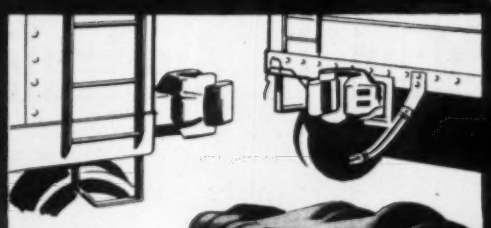

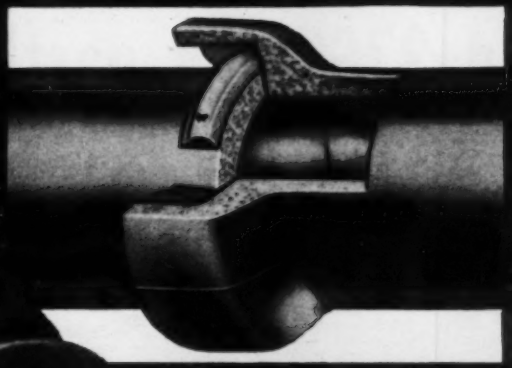

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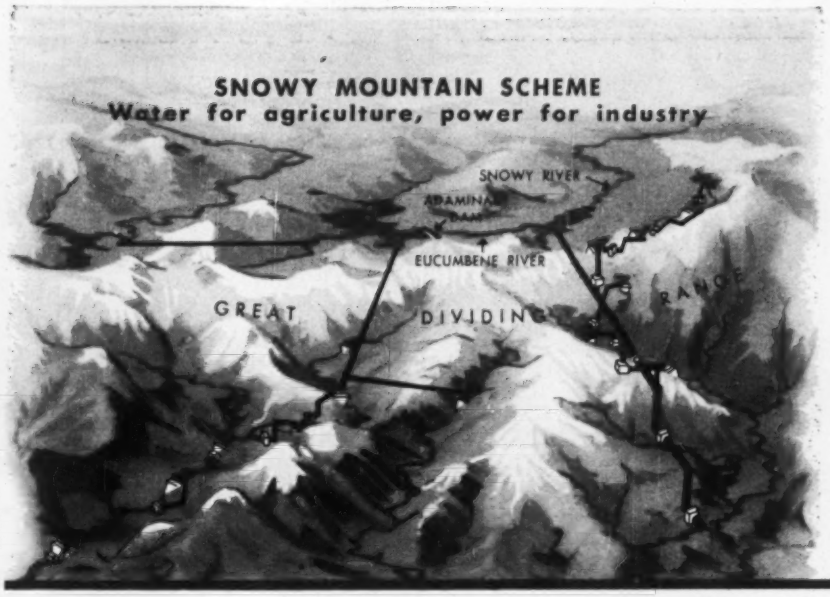
Kaiser-Walsh-Perini-Raymond, joint-venture U.S. contractors, build 376′-high earthfill dam in Australia

33 Tournapull® earthmovers help beat construction schedule in Australian Alps

Joint-venture contractors Kaiser-Walsh-Perini-Raymond are completing two phases of Australia's mammoth irrigation and power project in the Snowy Mountain watershed. The U.S. group's contract includes Adaminaby Dam — a 376′-high earth and rock fill dam — and a 14-mile tunnel thru the mountains. The dam — ½ mile thick at its base — is located on the Eucumbene River at Adaminaby, high in the Australian Alps.

8 Tournapull scrapers, along with 25 Tournapull Bottom-Dump units, haul heaped loads of dirt to build 376′-high Adaminaby Dam for Kaiser-Walsh-Perini-Raymond group, in mountainous region of Southeastern Australia. Dam is ½ mile thick at its base, and will impound 1,260 billion gallons of water.



Australia's Snowy Mountain Scheme is one of the largest hydroelectric developments ever undertaken. It will divert billions of gallons of water from the coastal rivers and carry it westward across the Great Dividing Range to the dry interior plains of Southeastern Australia. The additional water for irrigation will support an expansion of agriculture. Its downhill flow will generate electricity for power-hungry industry.

The work, requiring 2 decades to complete, involves construction of 7 major dams, 17 power stations, 83½ miles of underground tunnels, and 330 miles of aqueducts. Reservoir capacity for the entire project will be 1,827 billion gallons of water, which will ultimately generate 3,000,000 kw of power, and supply 650 billion gallons annually for irrigation. Revenues from electric power will liquidate cost of the project.

The 1,260 billion gallons of water to be stored behind this dam will be directed across Australia's "great divide", thru the tunnel to the Tumut River. There it will be controlled downstream to generate electricity (320,000 kw by 1959) for residential and industrial consumption . . . and to irrigate farms in the Murray and Murrumbidgee River Valleys, supplying 163 billion gallons in 1962.

4,860,000 cu yd of earth fill moved to Adaminaby dam-site by big Bottom-Dump and scraper fleet

For hauling the huge quantities of dirt, the Kaiser-Walsh-Perini-Raymond group used twenty-five 210-hp Tournapull Bottom-Dumps, which were loaded by three 3½-yd shovels. These haulers moved 11-yd payloads on approximately 6-mile cycles. Contractors' records show that Tournapulls averaged 22 loads each, on 9½-hour shifts.

In addition, 8 Model C Tournapull scrapers moved big loads of earth. They hauled steadily and spread quickly on the distant dam-site. On several occasions after rain, these 'Pulls* saved many hours of productive time for the Bottom-Dumps. The scrapers moved in and stripped off the mud to expose earth of proper moisture content . . . so shovel-loaded Bottom-Dumps could quickly resume production.

Work faster than anticipated

Efficient management, plus steady production of these 33 fast, maneuverable Tournapulls, helped contractors exceed the target of a 115'-high earthwall in 400 days. After just 338 days, earthmovers are shown building dam at 145' height.

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*Trademark CPCB-1762-DCJ-2

Tournapull Bottom-Dumps were loaded by shovels, hauled 3 miles to site of the earth and rock fill dam. Records show 25 units averaged 22 loads each, on 9½-hr shifts. Here on 145'-high fill, Tournapull operator prepares to spread a load on-the-run, as he receives signals from the grade foreman.

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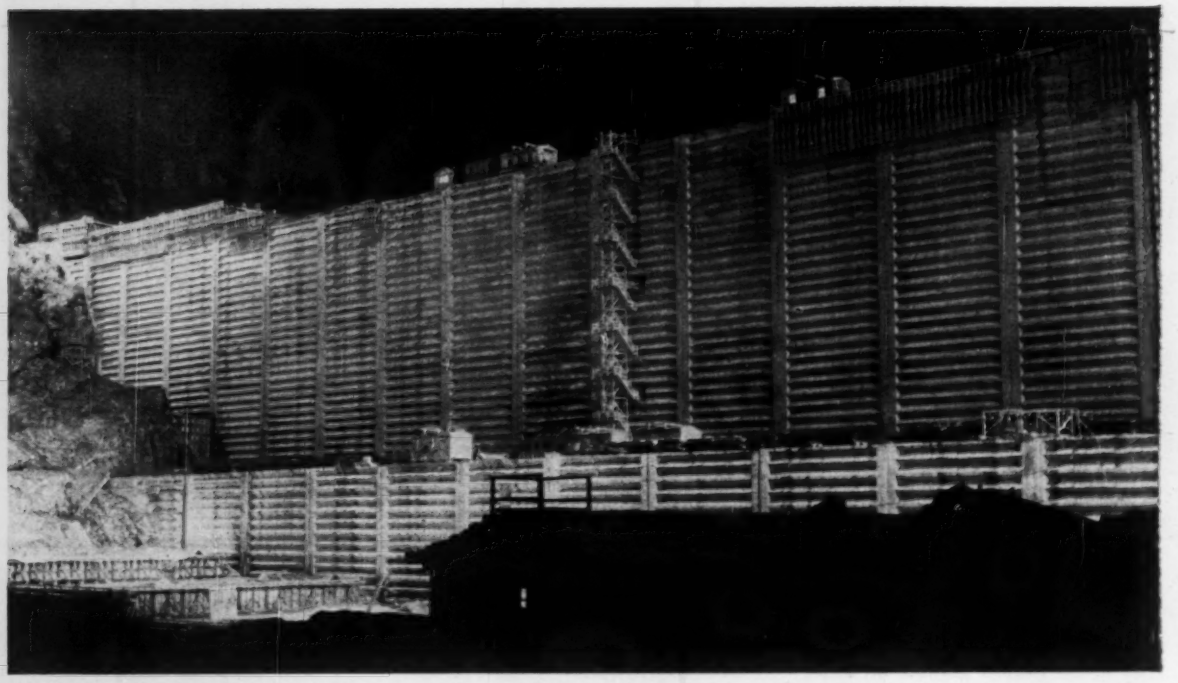
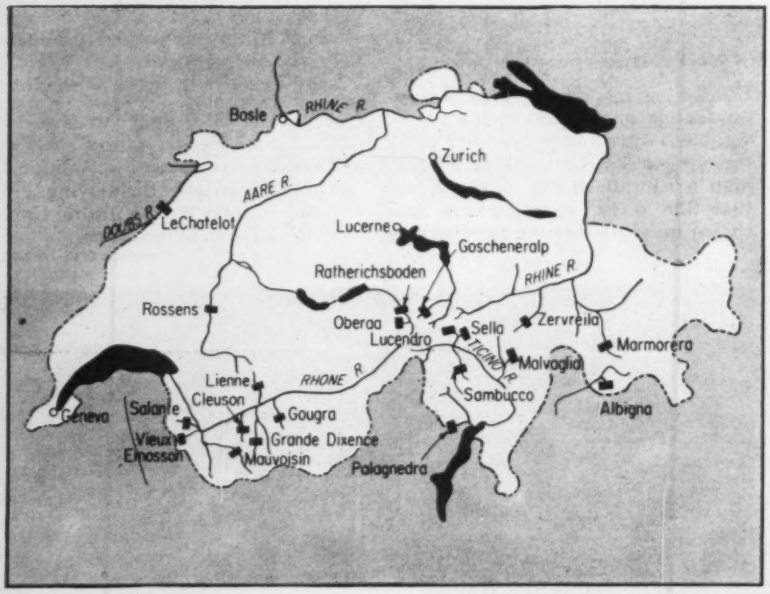


WORLD'S HIGHEST DAM, Grand Dixence, under construction in southwest Switzerland, will rise to 940 ft in three stages. Its downstream face is corrugated to provide an effective connection for the second stage.

Better, Bigger Dams—

The Swiss Contribution



RECENT SWISS DAMS are concentrated in the southern part of the country. All but Göscheneralp and Marmorera are concrete structures.

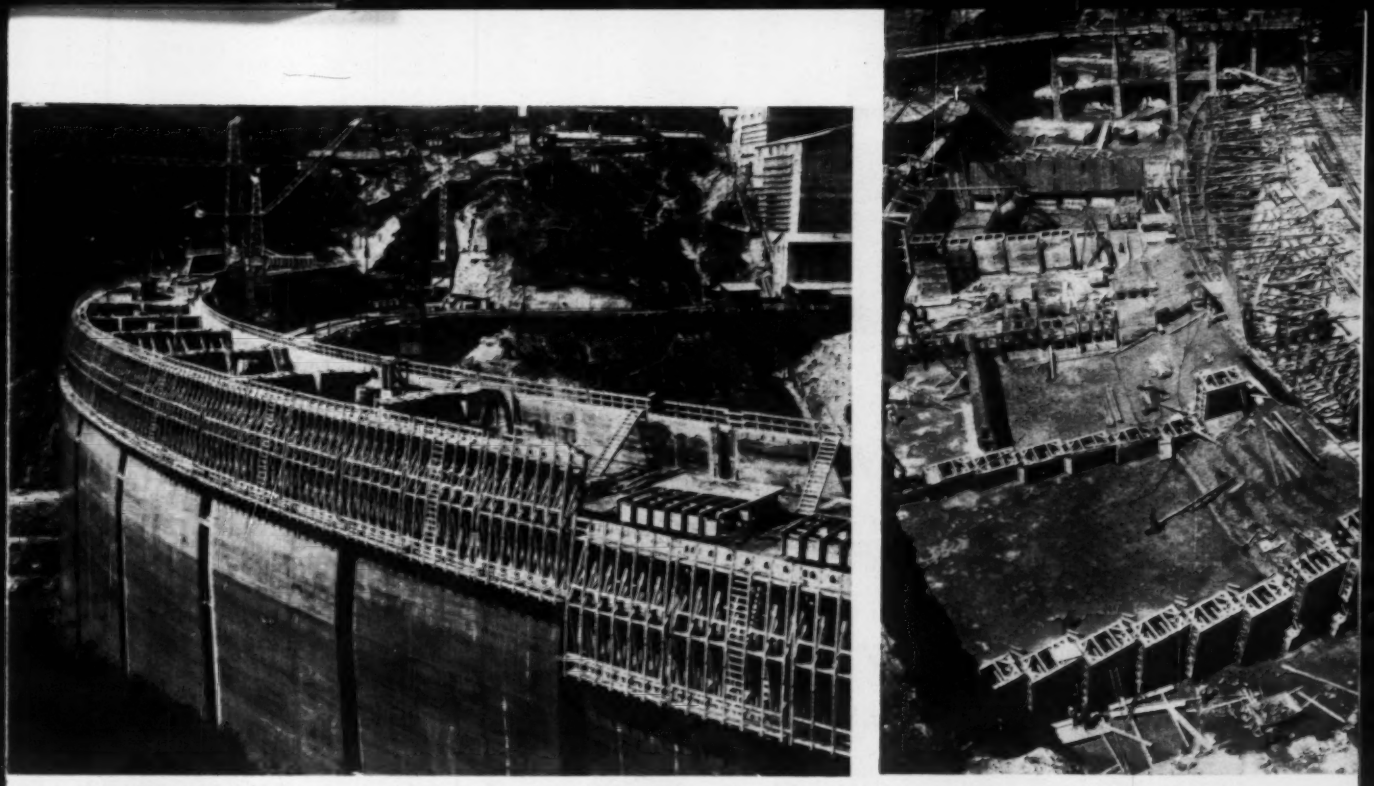
Henri Gicot
Consulting Engineer
Fribourg, Switzerland

Since the end of the last World War, the unceasing needs for electric energy have given rise in Switzerland to such activity in hydro construction that, if the rhythm is maintained, all the country's economically exploitable hydroelectric forces will probably be utilized by 1970 or 1980.

The facilities already built or in course of construction include, besides some installations of low head, a certain number of high-head plants served by reservoirs created artificially by dams, some of which are among the highest in the world.

The construction of large dams had begun in Switzerland by 1919, and the period between the two wars saw the construction of several structures, mostly of the gravity type. The largest was Waggital, 366 ft high and containing 305,000 cu yd of concrete (ENR Aug. 28, 1924, p. 345).

But it was after the last war that the



ROSSENS DAM, a 268 ft high arch founded on soft sandstone, was built with 5 ft wide open joints (left), whose faces were stepped by the use of special box forms (right). The use of 10 ft lifts of concrete was also introduced on this dam.

needs for new reservoirs and dams multiplied. From 1942 to 1956 sixteen new concrete dams were completed or under way, comprising a total volume of 17 million cu yd. These facilities carried the total energy accumulated in Swiss reservoirs to 5,300 million kwh. In addition, two more dams have just been begun: Albigna in the Bergell and Malvaglia in the Tessin. (See table, p. 78.)

Compared to the concrete dams, the number of earth and rockfill dams is small. There are two of them, however, which merit citing: Marmorera, finished in 1956 with a height of 264 ft, and Goeschenenalp, now under construction, whose height will reach nearly 430 ft.

The objective of this article is not to give a description of all these dams, but to present a synthesis of the principal problems that their execution has posed, and to point out the solutions adopted. It should be noted that Swiss dambuilders always have to take into account three basic considerations:

1. Climatic conditions in the high mountains. The majority of the projects are built at altitudes between 5,600 and 7,600 ft above sea level, where the mean annual temperature is in the neighborhood of 0 deg C. This limits the period for concreting to six or seven months and places the problem of refrigeration in an unusual light.

2. The use of only one quality of cement, normal portland. This requires the contractors to take account of the rapid and high development of heat of hydration. Also the absence of special cements and of admixtures, such as flyash or pozzolan, makes the problem of workability difficult.

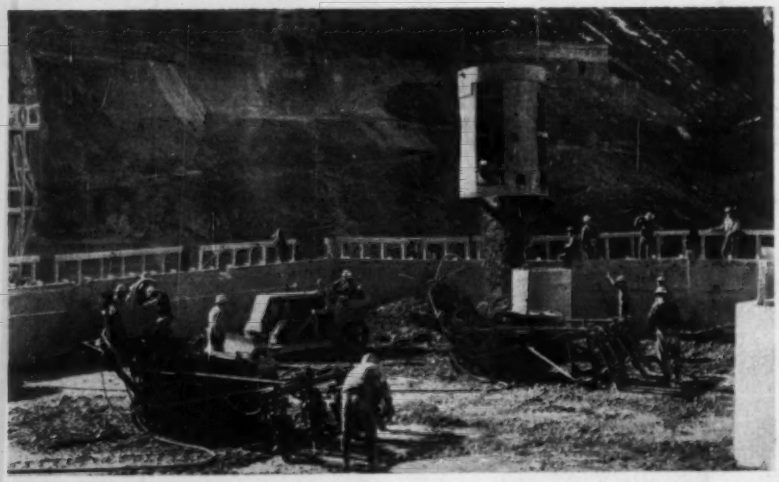
3. The requirements of the military authorities. According to the importance of the reservoir, the geographic conditions downstream and the possibilities of rapid lowering of the level of the water in case of an alert, certain minimum thicknesses are imposed, particularly in the upper parts of a dam. This naturally limits the liberty of design, particularly for hollow dams and multiple arches, which are considered especially vulnerable to bombardment. Nevertheless, the authorities must consider the economy of projects, and as a consequence they have recently approved construction of a relatively thin arch dam at Toules in the region of Grand St. Bernard. Here, however, the volume of stored water is rather small.

• **Geologic conditions**—Compared to certain other countries, the geologic conditions at Swiss damsites are generally quite favorable. No dam undertaken up to now has run into serious foundation difficulties, apart from problems of detail, although conditions are very diverse. Several dams are founded in granite or gneiss. This is the case for Lucendro, Ratherichsboden, Oberaa, Salanfe, Vieux-Emosson and Zervreila. Grande Dixence dam is founded on schist, Mauvoisin on calcareous schists, while Chatelot and Lienne are located on limestone. Finally, Rossens dam is founded on soft sandstone called molasse, whose modulus of elasticity is only about 6% to 10% that of concrete. It is without doubt the first large dam in the world to be constructed in this geological formation.

Geologic and geotechnic conditions are always the object of careful preparatory studies, on which the engineer and the geologist closely cooperate. The foundation soil is always explored by means of trenches, galleries or wells. This exploration is completed by systematic borings (including studies of the slope of the water), with holes sometimes drilled to great depths, even depths on the order of the height of the dam.

Geotechnic conditions are also closely examined and, for works of particular importance, one tries to determine the modulus of elasticity of the foundation rock, not by studies on samples in the laboratory, but by field measurements that take into account the influences of stratification and fissuration. These measurements, in general, are made by the seismic method, which permits determination of the dynamic modulus in different directions and over rather large distances. Supplementary studies of local deformation are also sometimes carried out in exploratory tunnels with the aid of powerful jacks.

. . . Topography and economy often dictate arch or gravity-arch dams



CONCRETE PLACING in large Swiss dams is highly mechanized, as here on Mauvoisin where bulldozers spread concrete deposited by bucket before tractor-mounted vibrators.

FOR CONSTRUCTION Mauvoisin dam was divided into blocks by radial transverse joints and a longitudinal joint concentric with the dam faces.

• **Choice of type of dam**—Mostly, however, it is not the geology, but topographical conditions and economic considerations that have guided the choice of types of dams. Thus it is that Swiss dambuilders try as far as possible to exploit the advantages of the arch dam, and to build arches or gravity-arches wherever the topography is favorable—even in some valleys relatively wide with respect to the height of the dam. Vieux-Emosson, for example, is a gravity-arch with a height of 164 ft and a length of 890 ft at the crown.

The dams of Rossens, Chatelot, Sambucco, Palagnedra, Mauvoisin, Lienne, Gougra and Zervreila are also of the arch or gravity-arch type. Lucendro dam was built of the hollow buttress Notezli type to economize on cement at a time when it was scarce. Cleuson dam, originally conceived as the same type, was partially transformed into a gravity dam at the demand of the authorities. Ratherichsboden and Oberaar are gravity dams equipped with small openings made by enlarging the expansion joints to a width of 10 ft between the 50 ft wide blocks. Albigna dam, now under construction, is the same type, but the open joints have been carried to a width of 16.4 ft.

In addition to the economy of volume, the objective of these openings is to reduce the coefficient of uplift used in the calculations.

Only three dams have been projected as gravity dams: Sella, Salanfe and Grande Dixence. For the first two, of very small height, their high ratio of length to height justified the selection of this type. At Grande Dixence, however, the question of type could be debated. The proportions of the valley were suitable for an arch-gravity dam, but in the upper part, on about one-fourth of the height, the abutments are bad. Also, at the bottom of the valley, the rock slopes downstream under the alluviums, while on the right bank the presence of a phyllitic rock posed some delicate problems.

For these reasons, and also because the requirement that the dam be built in five stages (later reduced to three) could be met more easily in a gravity dam than in an arch, the owner decided on a straight gravity dam placed at a narrow part of the valley where good tight rock is nearest the surface.

• **Profiles of dams**—For the transverse profiles of massive gravity dams, the classic triangular profile is now used in Switzerland, but with the crown widened. The calculations show, in fact, that for the given conditions of stability, at each height of the dam there is a certain width of the crown for which the volume of concrete is a minimum.

We no longer give the upstream face a batter, but make it vertical. At Grande Dixence, while the upper part of the face is vertical, it actually overhangs the lower part, which is inclined downstream on a 3% slope. This arrangement permitted a substantial saving of concrete while respecting the required conditions of stability.

With respect to stability, the present tendency is to demand that, for the normal hydrostatic load, plus the dead load and including an uplift varying linearly from 85% at the downstream to 0 at the upstream, the resultant remains in the central third; when adding to these loads the effect of a seismic shock with a horizontal acceleration of 0.1 g, the resultant should remain in the central two-thirds. Swiss engineers have not adopted the idea of a system of drilled drainage holes, permitting a reduction in the uplift pressure diagram following a broken line. In fact they believe the gravity dam has a very small reserve of security, effect of drilled drainage holes is too uncertain.

(*Continued on page 75*)

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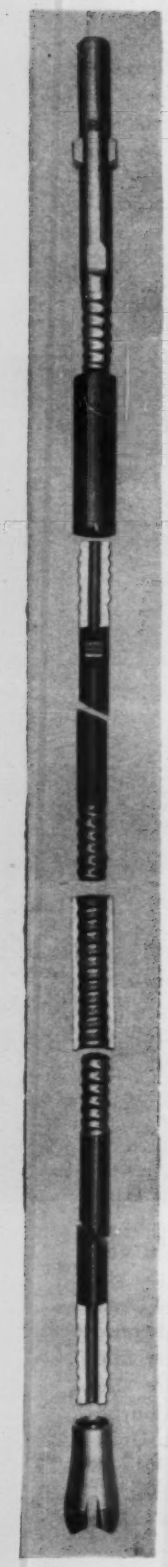

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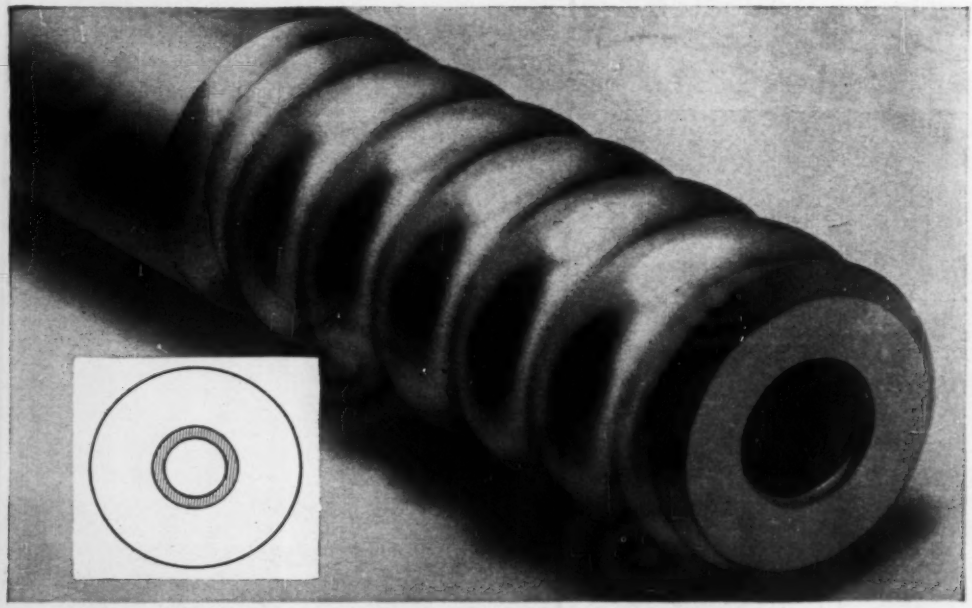

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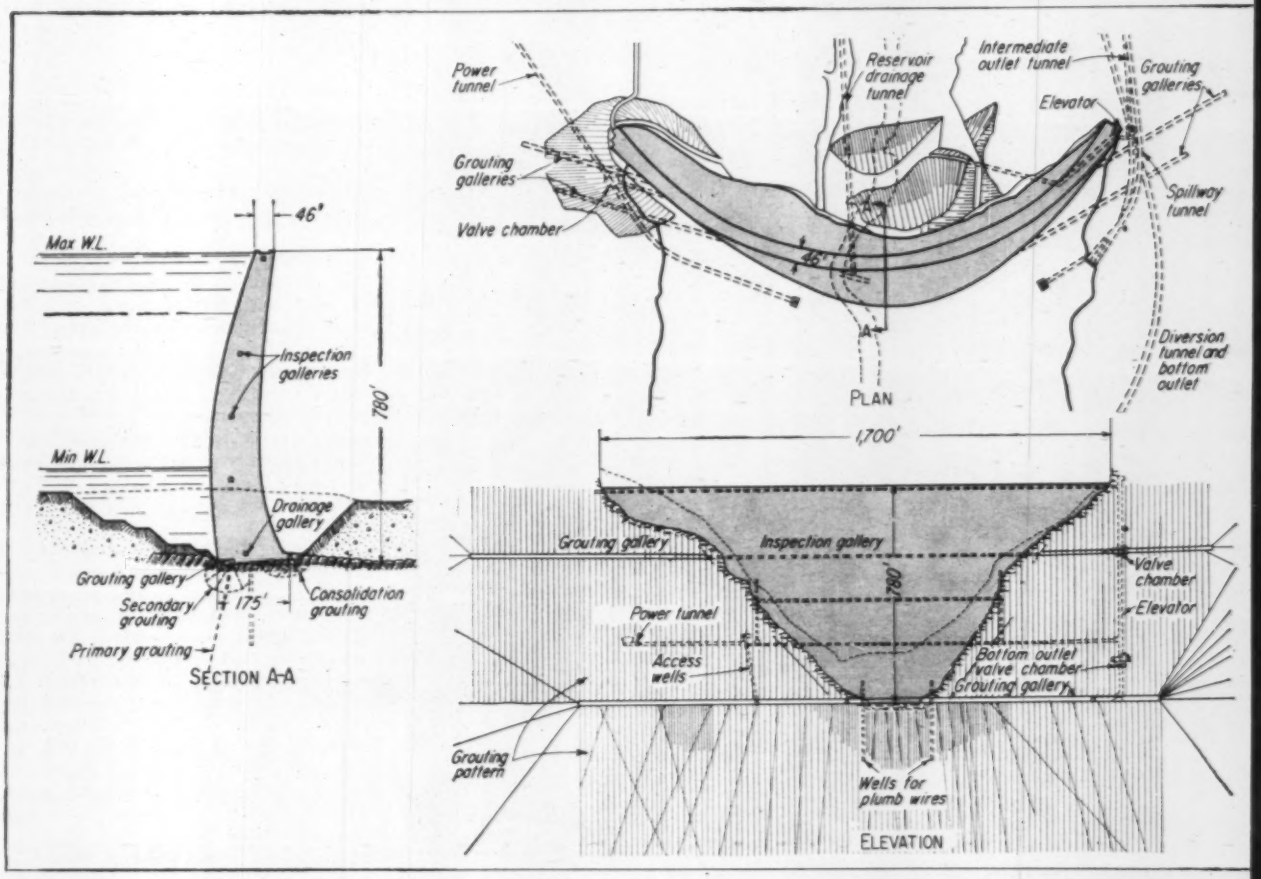
. . . Swiss dams rest on foundations of sound rock, often thoroughly grouted



MAUVOISIN DAM, the world's highest completed arch, is founded on a calcareous schist which required extensive grouting.

Although the profile of Grande Dixence dam was calculated according to the conditions mentioned above, and for a state of two-dimensional stress, every effort was made to create a reserve of security through a three-dimensional effect by grouting the contraction joints after cooling, like one does for an arch dam. Although the dam is practically straight in plan, the calculations have shown that the three-dimensional effect, negligible in the upper third, should be appreciable in the lower two-thirds and, above all, toward the foot of the dam where the gorge is narrow.

For arch dams and gravity dams in valleys whose form is irregular, Swiss engineers do not try to achieve artificial symmetry at the price of costly supplemental excavation or by the aid of abutments. They adapt the structure to the existing topography. A typical example of such adaptation is the arch dam of Lienne, about 525 ft high, in which the centers are located on a curve. The thicknesses of the arcs of the middle and lower region vary in a dissymmetrical manner to obtain favorable conditions of stress in spite of the dissymmetry of the valley. Another example is the arch-gravity dam of Vieux-Emosson, which is parabolic in plan.

The upstream faces of arches and gravity arches are not surfaces of revolution, but we seek to obtain on each level the most favorable curvature, following the principle of Jorgenson. Even on Rossens dam, located in a valley that is very wide at the base, the upstream radius of the arcs varies between 540 ft at the crown and 395 ft at the foot of the structure.

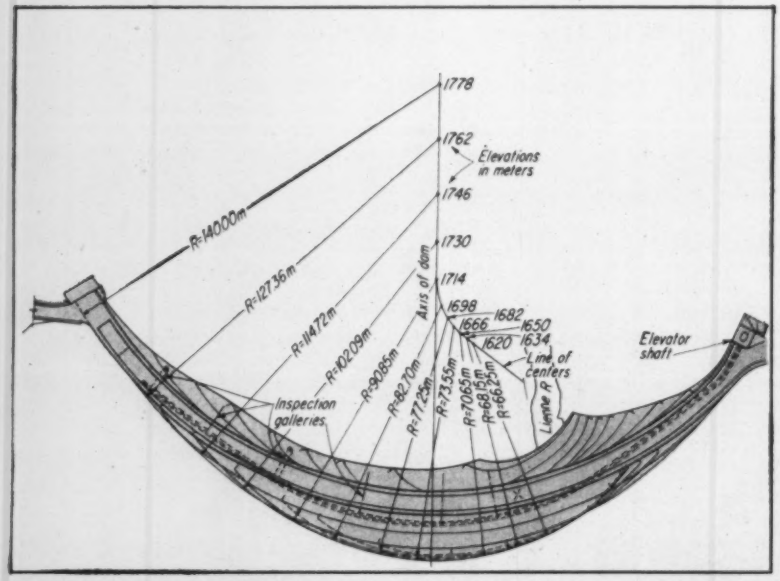
There is a tendency also to emphasize the double curvature of arch dams. The result is some thinner and more economical structures, at least to the extent the authorities will permit. This is the case where rather large dams are required to provide relatively small storage. This is the case at Les Toules in the region of Grand St. Bernard where a rather exceptional structure will be constructed soon. It will be a domed arch 300 ft high and 1,480 ft long at the crown, with a very small volume of concrete—300,000 cu yd. It will be parabolic in the lower part and elliptical in the upper part. The dam will also be built in two stages, the first of which is now under way.

Static calculations have always, up to now, been carried out by known methods based on the theory of elasticity. It is to be noted that the deformability of the foundation soil was introduced into the calculations for the first time in Switzerland on the Rossens dam in 1943. It is now always taken into account for arch dams. And even for the gravity dam of Grande Dixence, 940 ft high, account was taken of the influence of the elastic confinement of the triangular profile in the rock and of the points of stress that result from it.

• **Foundation construction**—The general tendency on foundation work is to limit excavation to that necessary to reach sound rock, and only to cut into this to the degree necessary to give the surfaces of support a suitable orientation. Aside from the grouting of the grout screen, great attention is accorded to consolidation grouting of the surfaces of

. . . Concrete placement gets special attention

RUGGED TERRAIN, as at Lienne dam, requires care and ingenuity in locating construction plant units. Batching plant shown literally hangs from cliff.



UNSYMMETRICAL DAMS ARE USED if the topography demands it. Lienne, a 525 ft high arch, is fitted into a very irregular valley. Note that the centers of curvature at different elevations are located on a curve.

the foundation. This grouting is carried to a depth of 15 to 30 ft and executed under moderate pressure, preferably after concreting a certain height of the dam.

In general, grouting is done with normal portland cement. At Grande Dixence a mixture of cement and clay was used for the grout screen.

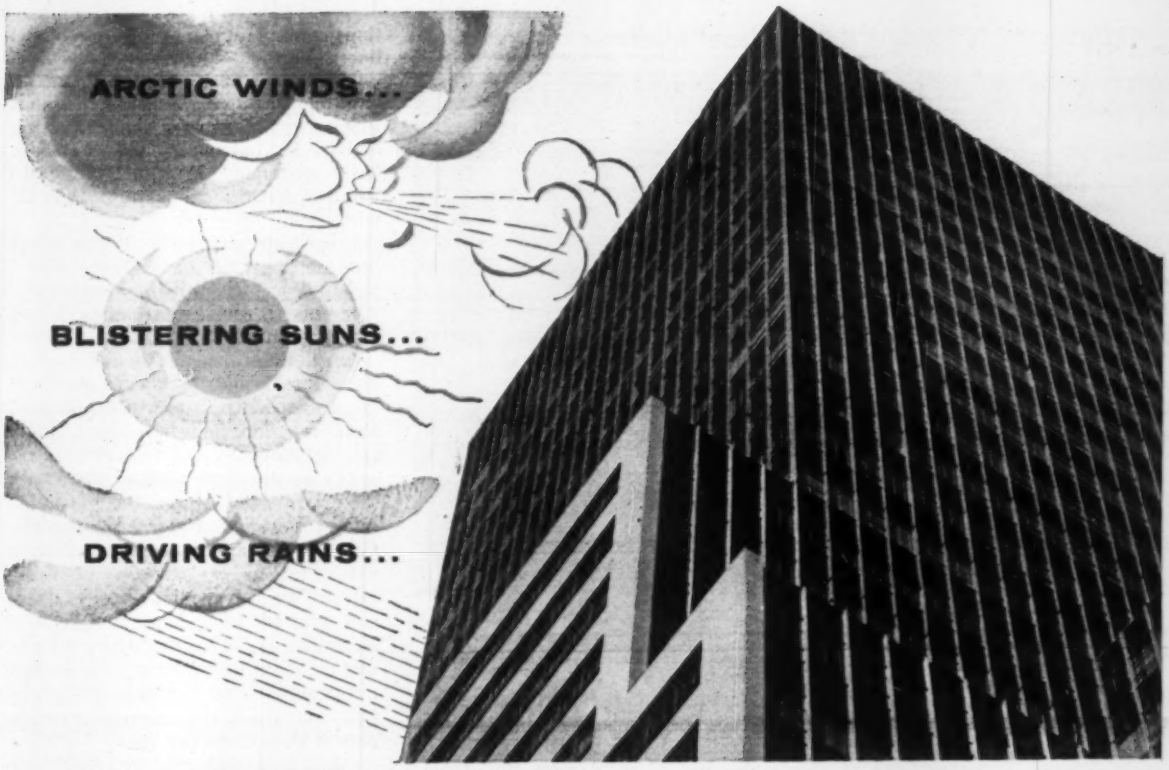
• **Concrete composition, placement**—Concrete composition is always made the object of extensive research since only normal portland cement is available. Because of its rapid development of heat—and for economic reasons—Swiss dambuilders seek to reduce the amount of cement. They compensate for the effect this might have on reduced strength by giving special attention to proportioning—particularly of sands—and by a rather severe limitation on the quantity of water. All large Swiss dam jobs today are equipped with installations for hydraulically classifying sands.

Reducing the amount of cement in the absence of such admixtures as pozzolans or flyash has created some difficulties with workability, in spite of the general use of air entrainers. To compensate for this, a particular technique has been developed in recent years for use on very large dams: concrete deposited by the buckets is distributed with the aid of small bulldozers, instead of vibrators. The bulldozers spread the concrete in regular layers. This procedure, introduced on certain Austrian dams, has been adopted at Mauvoisin, Grande Dixence, Zervreila, Lienne and Gougra.

In addition, complete mechanical vibration has been introduced, first at Mauvoisin and then at Grande Dixence. High frequency vibrators, usually 4 in. in diameter, to the number of 4, 6 or 8, are mounted in front of a bulldozer from where their operation is controlled mechanically. The advantages of the system are evident: Constant distances between the vibrators, constant vibrator inclination, regulatable penetration, controllable time of vibration, even automatic control of the movements of the bulldozer. In addition, the work is handled by a specialist and not dependent on common laborers.

• **Arrangement of joints**—For concreting, Swiss dams are naturally divided into separate blocks by transverse joints spaced from 50 to 60 ft. For the very large dams, the regions of greatest thickness are further divided by longitudinal joints. Thus, at Mauvoisin, the arcs in the lower region have been subdivided by joints concentric to the faces. Grande Dixence dam is also subdivided into several blocks by longitudinal joints, which are required also by the fact that

(*Continued on page 78*)



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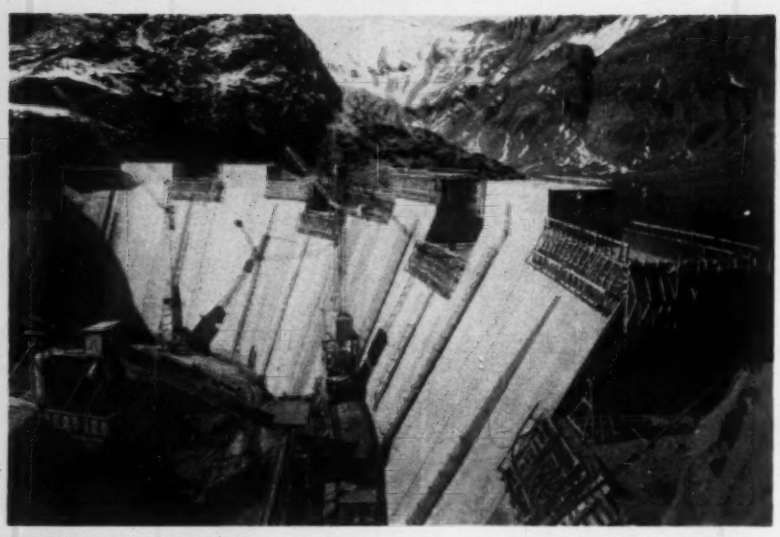


VIEUX-EMOSSON DAM, of arch-gravity type, requires a crown length of 890 ft to span this valley on the Swiss-French border.

construction will be carried out in stages:

The height of the lifts of concrete, previously rather small, was carried to 10 ft for the first time at Rossens dam. This height has proved economical, and has now been generally adopted along with the type of formwork utilized at Rosssens.

The transverse joints are executed in several ways: Some are left smooth just as they come out of the forms. Others are embossed by means of suitable formwork, as at Grande Dixence, and at certain dams even greater care has been taken to assure a correct transmission of loads between adjacent blocks. Thus at Rossens, which was built with joint openings at 5 ft, the faces of the joints were provided with teeth oriented to follow the directions of the principal stresses. Also at Lienne, we have provided lips at the parts of the joints in which the lines of the stresses are unusually oblique. This increases the resistance to friction or rubbing.

The joints in the lower part of Mauvoisin dam are embossed. The longitudinal joints of Grande Dixence dam are equipped with teeth whose directions correspond closely to those of the lines of stress.

Various methods have been used for grouting the joints. For certain dams (Chatelot, Mauvoisin and Dixence) metal tubes have been used—they have holes perforated at regular intervals. The perforated sections are surrounded with a muff of rubber, designed on the one hand to permit the mortar under pressure to get out of the tube, and on the other to prevent it from re-entering. The tube is thus available for future regroutings.

On other dams (Vieux-Emosson, Zervreila, Lienne) preference has been given to special valves, which fulfill the same function and have given every satisfaction.

On all the dams built to date, with the exception of Lienne, the grout pipe system has been arranged horizontally. Grouting was done from the exterior with the aid of falsework or flying bridges for the medium height dams, and even for some large ones such as Zervreila. However, at Mauvoisin and Grande Dixence, grouting was carried out from a series of wells joined by galleries, which the exceptional thickness of these dams permits.

At Lienne dam, the grouting facilities were vertical, not horizontal. For ease of execution, we introduced a new arrangement. In spite of the relatively small thickness of the dam a series of horizontal work galleries was built, spaced 5.5 ft, which corresponds to the limits of the grouting. All the grout pipes end at these galleries, so that grouting operations can be carried out in greater comfort than from exterior falsework and in any kind of weather. These galleries have also been used to accommodate the necessary refrigeration pipes.

• **Artificial refrigeration**—Contrary to the practice of other European constructors, Swiss engineers concern themselves with limiting the rise in the temperature of the concrete due to the heat of hydration of the cement, and with obtaining thermal equilibrium of the work before keying the joints by grouting. For refrigeration, we utilize everywhere today the circulation of cold water in metal coils placed on the surface of each lift. This system was proposed in 1944 for Rossens dam, following the American example. But the master of the work and the owner were opposed to it for diverse reasons, so that the dam was constructed using the system of cooling by open joints, supplemented by vertical wells placed at the center of the blocks and subjected to forced ventilation.

Because of climatic conditions, refrigeration by circulation of water in dams located at high altitudes is subject to some rather limiting conditions.

How Recent Swiss Concrete Dams Compare

Dam	When Completed	Type	Height (ft)	Region
Lucendro	1945	Hollow buttress	204	Gothard
Sella	1945	Gravity	130	Gothard
Rossens	1948	Arch	268	Fribourg
Cleuson	1950	Gravity [1]	290	Valais
Ratherichsboden	1950	Gravity [2]	290	Grimsel
Palagnedra	1952	Arch-gravity	250	Tessin
Chatelot	1952	Arch	240	Jura
Salanfe	1952	Gravity	180	Valais
Oberaar	1953	Gravity [2]	340	Grimsel
Sambuco	1954	Arch	330	Tessin
Vieux-Emosson	1955	Arch-gravity	164	Valais
Lienne	1956	Arch	525	Valais
Zervreila	1956	Arch	490	Grisons
Mauvoisin	1957	Arch	780	Valais
Gougra	1957	Arch	420	Valais
Grande Dixence	Under const.	Gravity	940	Valais
Albigna	Under const.	Gravity [2]	360	Bergell
Malvoglia	Under const.	Arch	290	Tessin

(1) Converted from a hollow buttress type

(2) Enlarged expansion joints create small hollows in these dams

Where the mean temperature of air and natural water is in the neighborhood of 3 deg C, or even lower, refrigerating machines have little value, and better use can be made of natural water. Then cooling should be done continuously or nearly so. Cooling in the summer permits reducing the thermal peaks, and obtaining an initial lowering of the temperature. The completion of cooling is accomplished in winter, and it is then important to key the joints before the effect of exterior heating makes itself felt in the mass of the concrete.

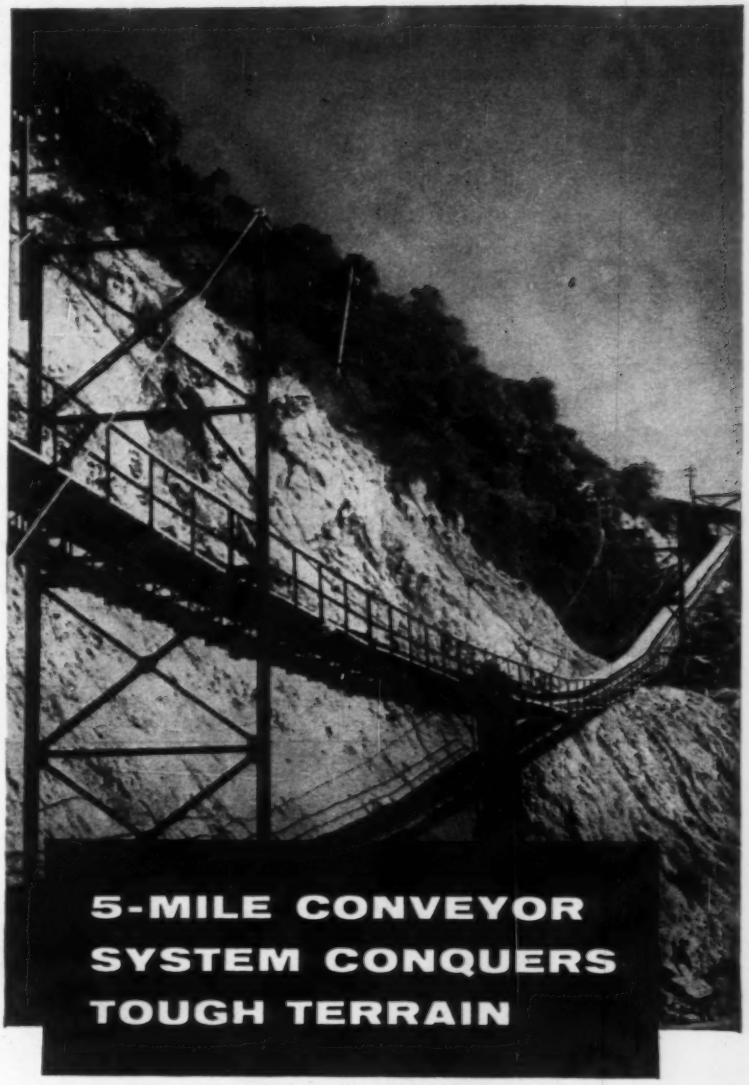
• **Earth and rock dams**—While Switzerland possesses a respectable number of notable works in concrete it has completed only two embankments of large dimensions—those of Marmorera and Goscheneralp. Although their constructors were inspired by American examples and experiences, they have been able to adapt them to Swiss conditions.

Marmorera dam is an earth dike about 263 ft high. Its trapezoidal profile has a crown width of 40 ft, an upstream slope varying, bottom to top, from 1:3 to 1:2.25, and a uniform downstream slope of 1:2 interrupted every 33 ft by a berm. The dam has a central watertight core of moranic material, protected up and downstream by filters, while the body of the structure is of semi-permeable alluviums and gravel. The upstream face is protected by a rockfill. In the lower part of the core a reinforced concrete cutoff is used, which is extended very deep into the subsoil of the left bank where the dike does not rest on rock.

The construction at Marmorera was subjected to two difficulties. First, materials of the body of the dam were not permeable enough, and had to be washed in an artificial lake. Second, rain caused frequent interruptions of the compacting work.

Göscheneralp dam, now under construction, reaches a height of nearly 425 ft. It is of the rockfill type with a central watertight core. The construction plant includes a very complete installation for the preparation of core and filter materials and is widely spread out because of the danger of avalanches. Another unusual feature, used for the first time in Switzerland, was a method of drying sand by employing sieves like electrical resistances. To permit compacting the core, even during rain, the work area was covered by a roof. The job was also floodlighted so that no time would be lost in completing the compacting.

Broadly speaking, Swiss dam constructors have profited from the experiences of other countries. They have not, however, been content to copy blindly what is done elsewhere, but have developed methods adapted to the particular conditions of our country.



To build India's huge Bhakra Dam, sand and gravel must be brought over three miles of mountainous terrain. In one section a suspension span supports a 1700-ft. long, 36" wide belt conveyor which carries 750 tons per hour at 485 FPM up a 107-ft. lift. Another two miles of belt conveyors move aggregate through processing operations.

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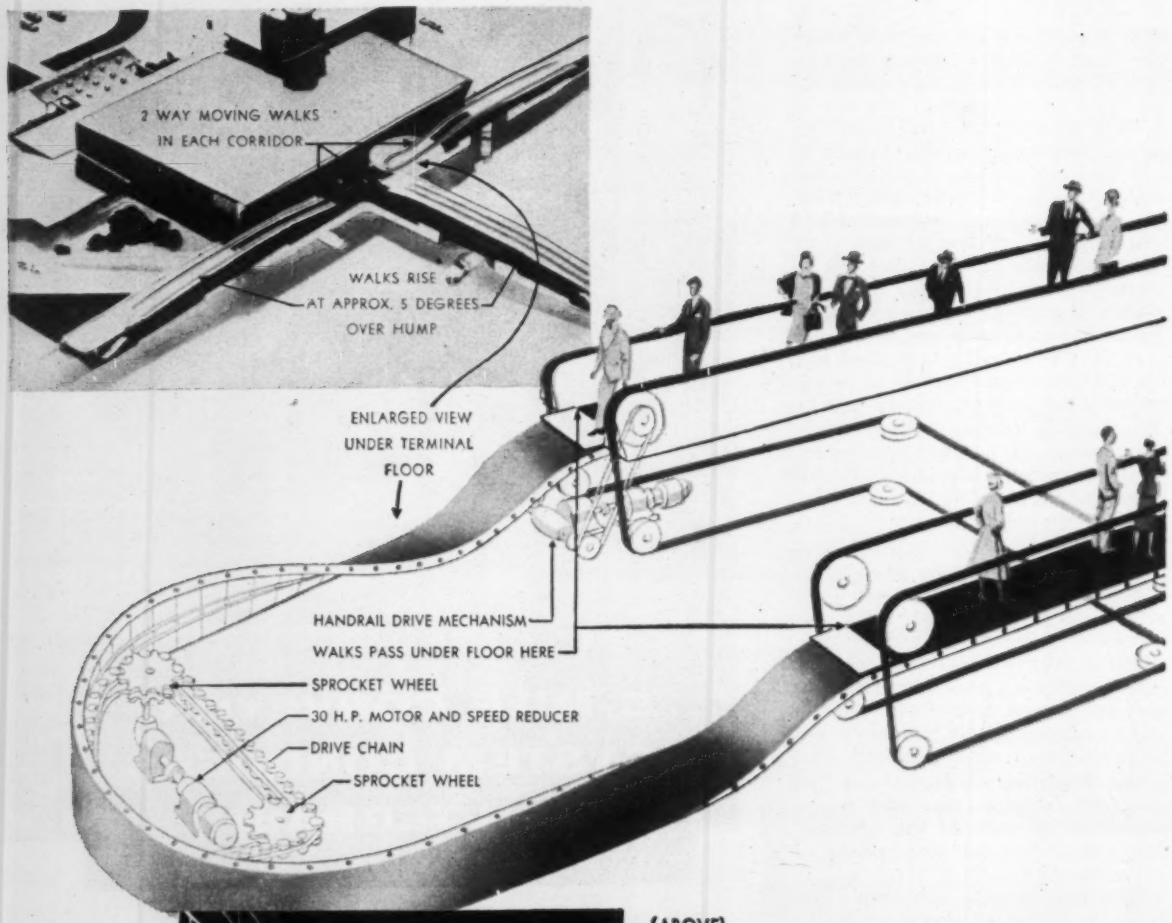

(ABOVE)
Schematic drawing showing the "Glide-Ride" moving sidewalk designed, manufactured and installed by HEWITT-ROBINS, INC., at the Love Field Air Terminal, Dallas, Texas.

(Opposite page)
Detail of balustrade with some of the various Revere Aluminum Extrusions used in the conveyors. The unseen track on which the handrail operates is extruded from Revere Bronze shape shown at bottom.

(LEFT)
"Much better than walking," say users of this moving sidewalk that has been a big hit ever since the day it was put into operation.

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These new Glide-Ride conveyors were designed, manufactured and installed by HEWITT-ROBINS, INC. Playing 2 important roles in these conveyors are 22,000 lbs. of Revere Aluminum Extruded Shapes and 22,000 lbs. of Revere Extruded Bronze. The aluminum extrusions were used as floor cove molding, handrail molding, spoon molding between balustrades and rubber carpet, and as a wall cove between handrail and wall. Not only are these Revere Aluminum extrusions attractive and decorative but their satiny finish will remain so for years with an occasional soap and water cleaning the only maintenance required.

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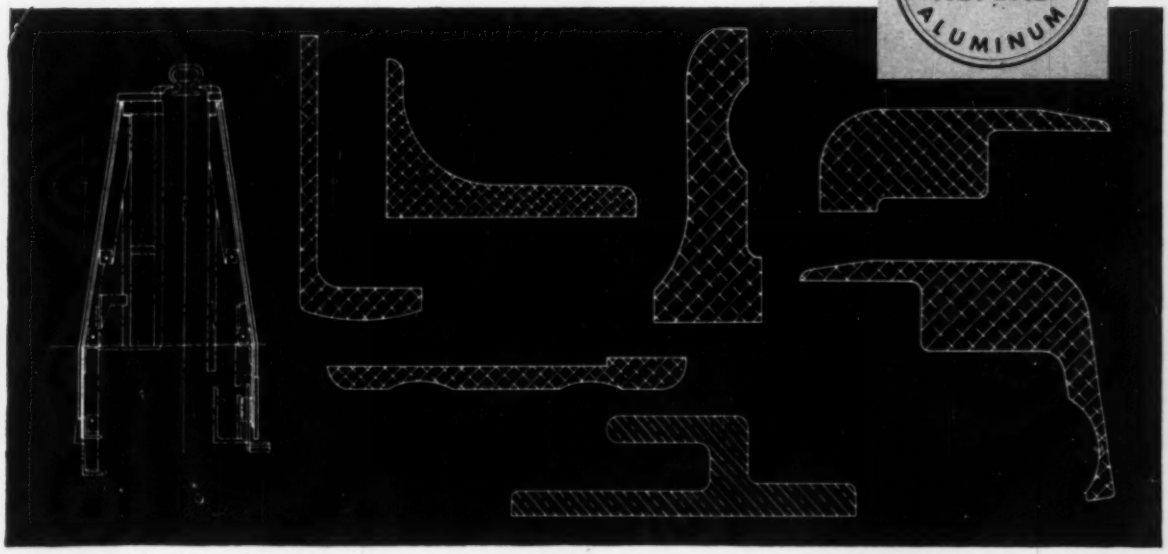
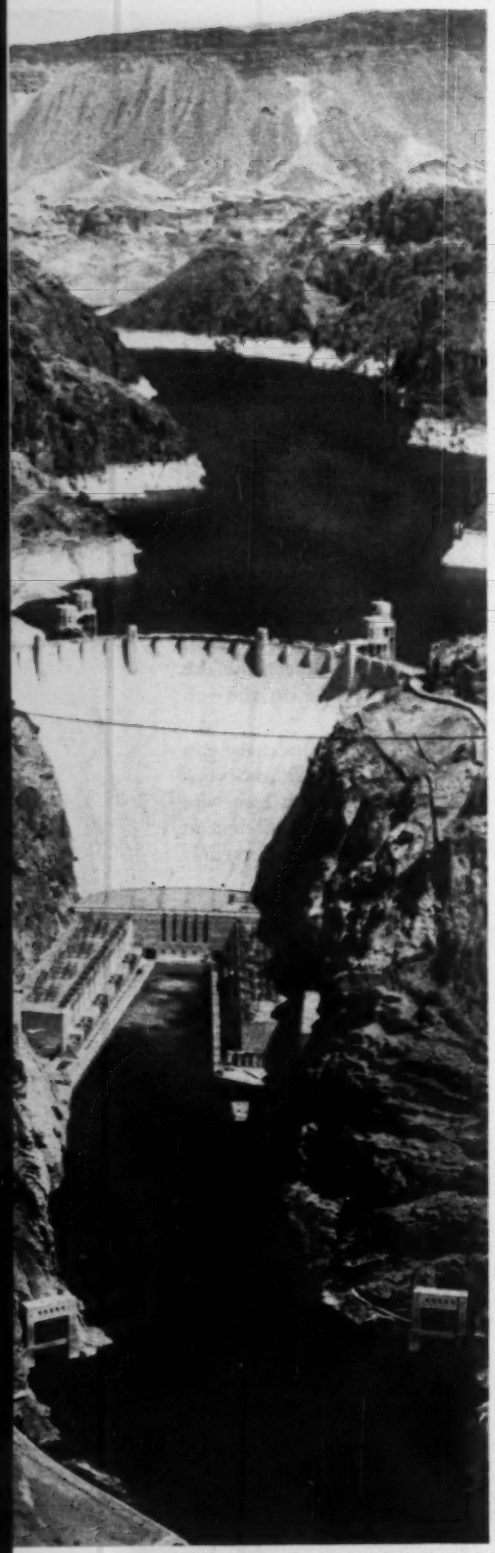
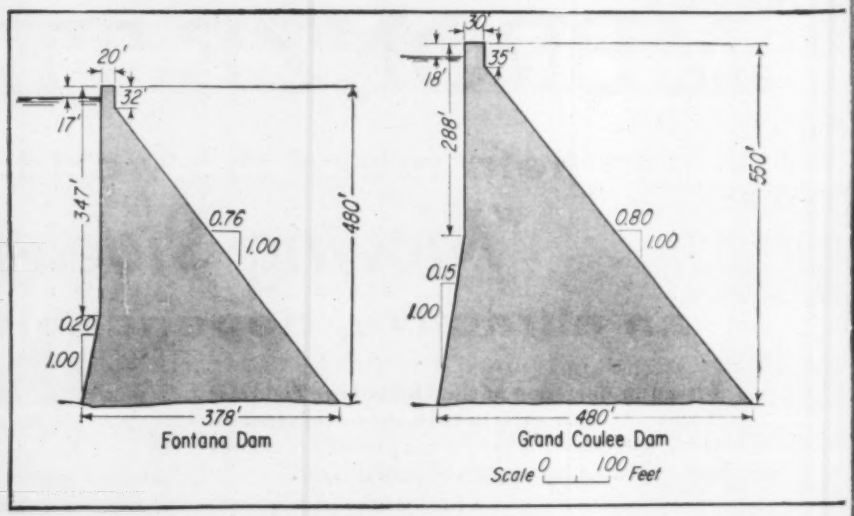




HOOVER DAM, the famous 726 ft arched-gravity structure completed in 1936, led the way to low-cost high dam building.



MODERN GRAVITY DAM PRACTICE, exemplified by maximum cross sections of Fontana, Grand Coulee and Shasta, has evolved a return to designs of clean straight

Better, Bigger Dams—

The United States

Calvin V. Davis
President, Harza Engineering Co.
Chicago, Ill.

As we enter the nuclear age we must still remind ourselves that dams remain the heavyweight champions of the civil engineering field. They are still the largest single structures yet created by man.

What have been the trends during recent years in dams designed and built by American engineers and contractors? We have seen larger dams built on larger rivers. We have seen progressively less favorable damsites successfully utilized. We have seen more multiple-purpose dams come into being, although no completely new structural types have come on the scene.

We also see contrary to belief widely held abroad, that American designers are not hypnotized by mass concrete dams. On the contrary, American engineers are continuing to show themselves responsive to conditions peculiar to this country, such as large rivers, high cost labor, large construction equipment and utility financing. At the same time American engineers have an intense interest and high regard for the achievements of their foreign counterparts.

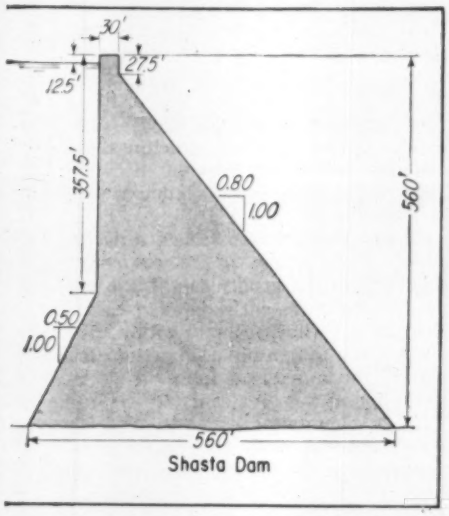
• **Gravity dams**—The curved theoretical profiles of the gravity-type dams of a generation or more ago have been replaced by the clean, straight lines that characterize Fontana, Grand Coulee and Shasta Dams. A more pleasing appearance and savings in construction cost have resulted.

Ratios of base width to height somewhat lower than the standards of 25 years ago are now found acceptable. And modern concrete design would permit heights well in excess of 1,000 ft and allowable maximum compressive stresses up to 1,500 psi.

Transverse contraction joints, which were formerly spaced 75 to 100 ft, are now usually placed 50 ft apart. Details differ widely. The Bureau of Reclamation keys and grouts these transverse joints while the TVA prefers to leave them open. The trend is difficult to define. Open joints, however, represent an advance in design because each block is better able to adjust to its own load; the openings between blocks provide better opportunities for drainage and the reduction of uplift; shear-twist is eliminated; and they save money.

Longitudinal joints are usually of the vertical saw-tooth type. These provide jointing surfaces that coincide approximately with planes of zero shear. But the present tendency is to minimize or eliminate such joints through improved methods of temperature control.

Temperature rises in the concrete—caused by rapid concreting and creating cracking problems—have been controlled by the circulation of cooling water through pipes in the finished concrete, but this method is troublesome and expensive. Accordingly, the Corps of Engineers is now taking another route:



lines in contrast to the curved theoretical profiles of an earlier day.

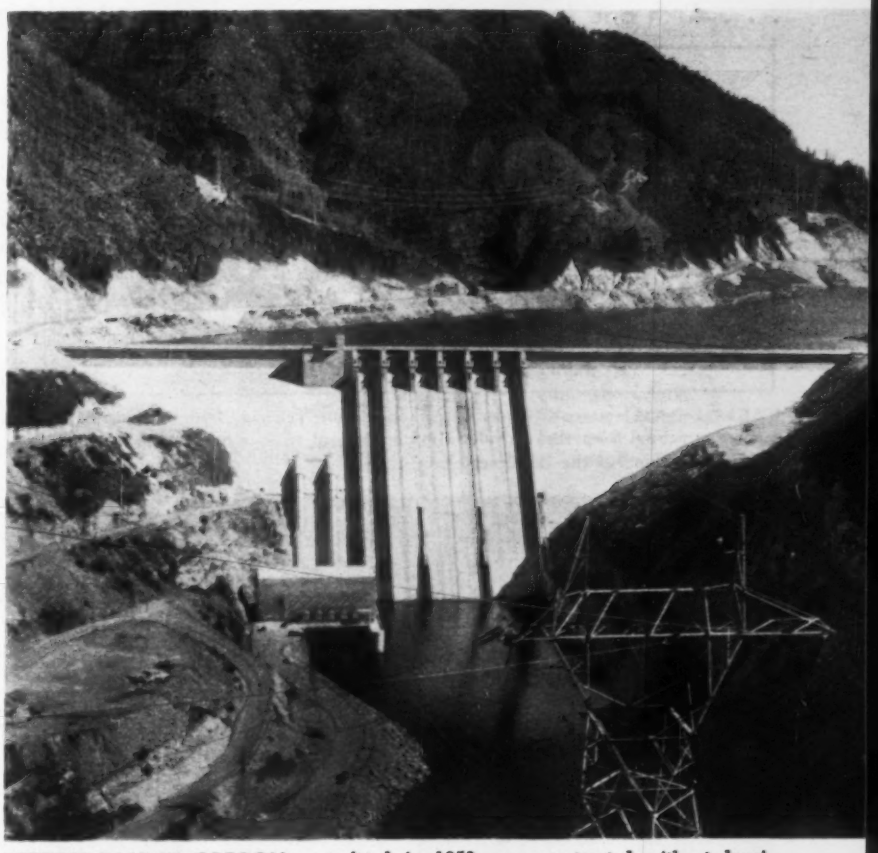
Contribution

Improvement in concrete and pre-cooling of aggregate.

Reduction in cement was the first objective. Not only does cement produce the heat that causes the cracking, but it is the most expensive ingredient of concrete. Air entrainment, introduced nearly 10 years ago, saved up to 47 pounds of cement per cubic yard of concrete and resulted in concrete with superior weathering resistance. Then improvement in aggregate gradings made it possible to replace 50 cents worth of cement with 5 cents worth of aggregate. Other savings are being made by the substitution of pozzolans for cement; the resulting loss of strength is negligible and heat yield is reduced greatly.

By these and other measures the Corps of Engineers has obtained satisfactory concrete containing as little as two sacks, or 188 lb, of cement per cubic yard.

Notable advances also have been made in foundation drainage for gravity dams. Substantial savings in construction cost result from providing positive means for relieving uplift pressure in the foundations and in the dam. And paralleling advances in drainage system design have been improved curtain grouting and foundation treatment. As an example of modern practice, a 100 ft deep grout curtain was placed upstream of the drains in the foundations of Detroit Dam, the drains, incidentally, consisting of 65-ft-deep holes drilled on 10 ft centers.



DETROIT DAM IN OREGON, completed in 1953, was constructed without longitudinal joints. Deep grout curtain and foundation drains are also marks of modern design.

• **Arch dams**—Engineers have attempted broad classifications of arch dams on the basis of thickness, symmetry with respect to the crown section and extrados and introdos characteristics. Selections of structural form falling within classifications such as thick-arch, thin-arch, constant-radius, constant-thickness, variable-radius, constant-angle, and others of like nature, have been governed to a large extent by site characteristics. But all of this overclassification may have obscured an outstanding advance: The achievement of the structural form that provides a maximum load transfer to the arch elements and a minimum load transfer to the cantilever elements.

Actually, as long as 25 years ago designers recognized that water loads were being transferred to the abutment by interior arch action within massive horizontal sections that were not shaped to function efficiently as arches. This naturally suggested elimination of redundant concrete and fitting the structural form to the more efficient arch sections. Engineers the world over are now reaching agreement on this principle.

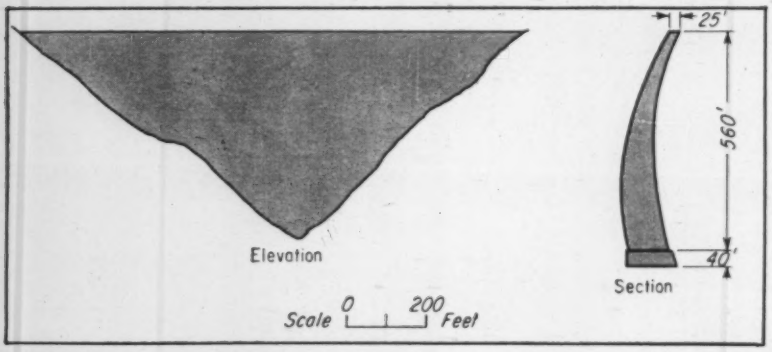
But while the principle is simple enough, applying it is often difficult. Nevertheless, when it is applied to arch dams constructed in deep V-shaped canyons, the double-curvature type dam results. An example of agreement between both French and American engineers on the selection of this type is found in the 600 ft high Karadj Dam, now under construction near the city of Teheran, Iran.

To give full credit to individuals contributing to arch dam progress is an impossible task, but the names of Jorgensen, B. F. Jacobsen, Ivan Houk, Julian Hinds, and the late Fred A. Noetzli come to mind immediately as pioneers in American design.

The Bureau of Reclamation has designed and constructed many important arch dams. The 295 ft high Seminoe Dam, built on the North Platte River in Wyoming in 1938, has a base-height ratio of 0.30. Now, 20 years later, Yellow Tail Dam, authorized for construction on the Big Horn River in Montana, and the Flaming Gorge Dam, authorized for the Green River, Utah, are designed for maximum heights of 520 and 492 ft, respectively, but with base-height ratios of only 0.34 and 0.27. The trend toward the elimination of redundant concrete appears firmly established.

Examination of the experiences of

. . . Arch and buttress dams save concrete



KARADJ DAM, currently under construction near Teheran, Iran, is designed in the modern structural form that provides a maximum load transfer to the arch elements with a minimum going to the cantilever elements.

HUNGRY HORSE DAM of arched-gravity design and 564 ft high, exemplifies the simplicity of construction and low unit costs that characterize structures of this type.

Ebasco Services, Inc., also reveals progress in terms of savings in quantities and construction cost. In common with other arch dam designers Ebasco has, through the use of pure arches, made enormous reductions in concrete—in many cases the volume of concrete is cut to less than 20% of that in a comparable gravity dam.

The "arched-gravity" dam, which relies for stability jointly on arch and gravity action, also should be mentioned, particularly since such important structures as Hoover Dam and Hungry Horse Dam in Montana are of this type. Simplicity of construction and low unit costs are usually characteristic of the arched-gravity type. Relatively low-cost mass concrete and simplified panel forms have, at many sites in the United States, made the arched-gravity dam more economical than either the straight gravity or the more complicated thin-arch types.

The U. S. Bureau of Reclamation has made notable advances in this type, as the accompanying drawing comparing Glen Canyon Dam, now under construction, and Hoover Dam, built 30 years ago, makes plain.

• **Buttress dams**—Modern high buttress dams are more massive than earlier structures. Wider buttress spacings and thicker concrete sections bring together the inherent economy of the buttress dam with that of mass concrete construction. The result is a structure that contains somewhere between 40 and 50% of the concrete in a comparable gravity dam.

This structure has a formed surface, which either equals or exceeds only slightly that of a gravity dam. Little or no steel reinforcement is required. Each elementary inclined column within the buttress acts to transmit a proportionate part of the water load from the deck to the foundation. All concrete acts directly in compression.

In these respects the modern massive-buttress dam has many properties in common with the modern arch dam. Each uses concrete most efficiently in compression. Unlike the gravity type, neither the buttress dam nor the arch dam uses concrete as a counterweight. The buttress dam achieves great economy through substitution of a stabilizing vertical water load for a much more expensive vertical concrete load.

Progress in buttress dam design and construction in the United States has been intermittent and sporadic. Great advances have gone unrecognized for many years. Only now are we starting to appreciate the contributions to progress made by Ambursen, Noetzli, Olberg, and others who have pioneered in this field. The creative genius of these engineers can now be evaluated against the present world-wide trends in buttress dam design. Their work is enduring.

Going back 30 years, Coolidge Dam, constructed by the U. S. Indian Service on the Gila River in Arizona, represents an outstanding advance in buttress dam design. It is 250 ft high and its two buttresses are spaced 180 ft center to center. Here we find an early demonstration of the previously mentioned principle—wide buttress spacings and massive sections result in savings in construction cost. The late Major C. E. Olberg, then assistant chief engineer, U. S. Indian Service, demonstrated to the satisfaction of two consulting boards that his proposed design for Coolidge would be more economical to build than a conventional multi-arch dam with relatively thin buttresses 60 ft on centers.

From the records of the Ambursen Engineering Corp. may be drawn other examples illustrating that the same principle applies also to the Ambursen type dam. This type may be credited to the late Nils F. Ambursen, who demonstrated as early as 1903 the savings inherent in the slab-and-buttress reinforced concrete type dam that has since carried his name. More than 350 dams

(*Continued on page 87*)

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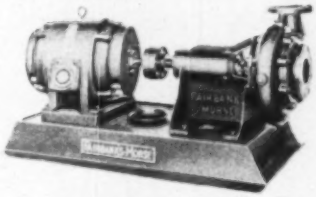

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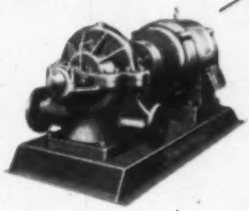

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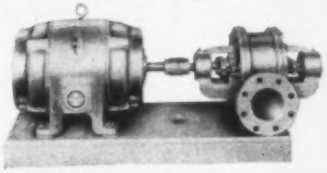

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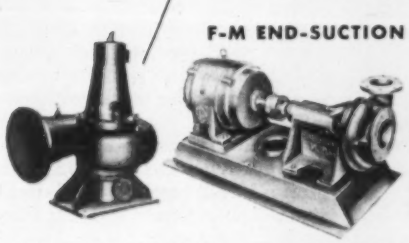

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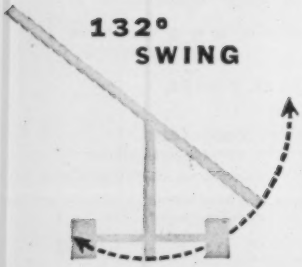

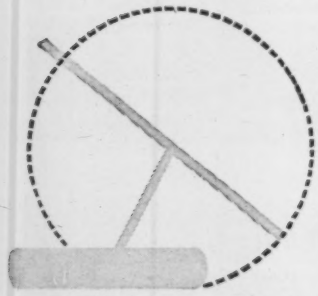

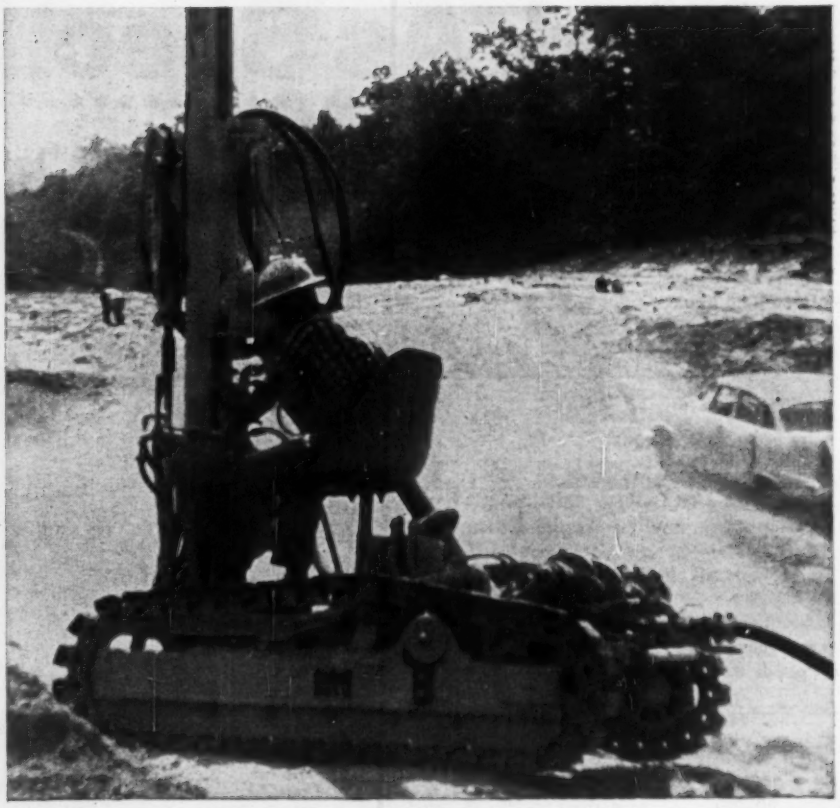

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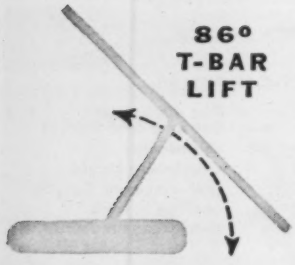

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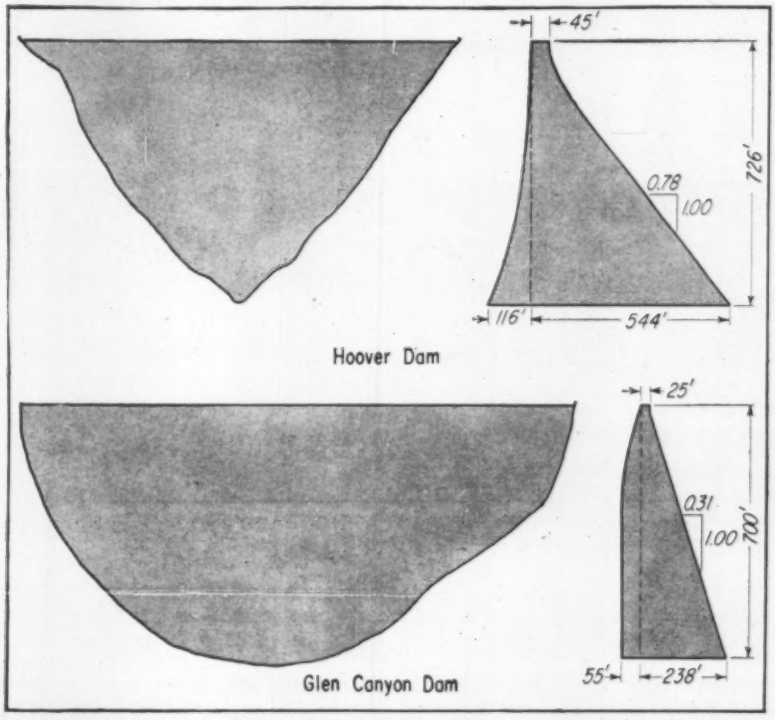
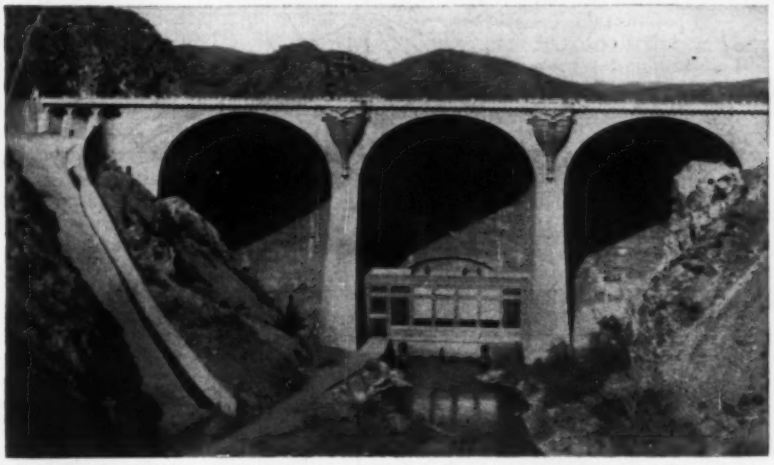


CONTRASTING SECTIONS in arch-gravity dams over a period of three decades are evident in a comparison of Hoover Dam with Glen Canyon Dam, now under construction.



COOLIDGE DAM, built 30 years ago, introduced an outstanding advance into buttress dam design by using wide buttress spacings and massive sections to get lower cost.

of this type have been built, with progressively wider buttress spacing and increasing thickness of individual buttresses.

These changes in massive buttress dams are brought into sharp focus by Peligre Dam, a 233 ft high irrigation and power dam on the Artibonite River in northeast Haiti, designed by Tippetts-Abbett-McCarthy-Stratton, and recently completed.

One important factor affecting the choice between the thin-buttress and thick-buttress—or possibly gravity-types—may be the constantly changing relationship between the costs of labor and materials. For this reason, other advances in the thin-buttress type, made since 1927, must not be discounted. One seems quite significant—the double-walled buttresses that characterize Big Dalton Dam, built by the Los Angeles Flood Control District, and Bartlett Dam, built in 1932 by the Bureau of Reclamation. This feature results in a large saving in the volume of concrete as compared to a multiple-arch dam of the more conventional type. This advance also must be credited to the late Fred Noetzli.

Model testing also has become an important tool for verifying the designs of major buttress dams. An unusual demonstration of the advances in this field is the stress analysis performed by Dr. Durelli of the Armour Research Institute, using models patterned after a 550 ft high buttress dam designed by Harza Engineering Co.

Two models were used, one to analyze the stresses due to the weight of the buttress and the other to evaluate the stresses resulting from hydrostatic pressures. The effects of gravitational loading were measured on a plastic model of the highest buttress reproduced at a scale of 1:1000. The effects of hydraulic loading were measured on an aluminum model, scale 1:300. Electrical resistance-type strain gages then were fastened to the model as shown in an accompanying illustration, and the readings combined with the data from the brittle coating tests to define precise stress values.

• **Earthfill dams**—Although fill structures have been built since time immemorial, it was not until the birth of soil mechanics in the 1920's that their design became something more than rule-of-thumb. The impetus of a new and rapidly growing design technique was matched by advances in construction and field control procedures. The improvements in excavating and hauling equipment permitted placing large volumes of fill of controlled quality at increasingly economical costs.

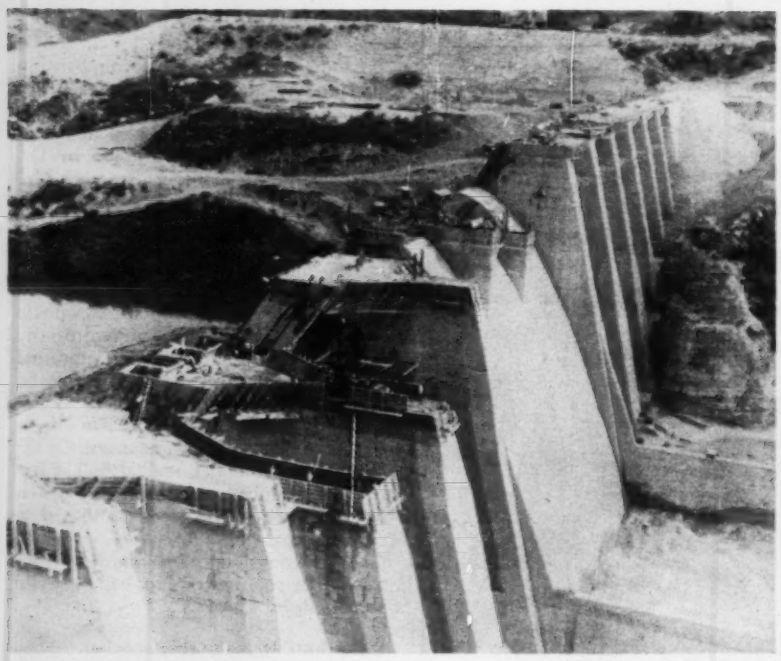
In recent structures, along with dramatic increases in height, has come a steepening of slopes to the limit permitted by foundations. This is demonstrated in an accompanying drawing showing Yale Dam, Washington, designed by Ebasco Services, Inc.; Swift Dam, Oregon, designed by Bechtel Corp.; and Trinity Dam, California, designed by the Bureau of Reclamation.

Early earthdams were built with relatively wide central core sections flanked by pervious shells and frequently generous rock zones. Typical of the construction of 20 to 30 years ago, Mohawk Dam has a core with a horizontal thickness of more than twice its height. In contrast the ratios of core thickness to hydraulic head at the base of Yale and Swift Dams are 0.20 and 0.25, respectively.

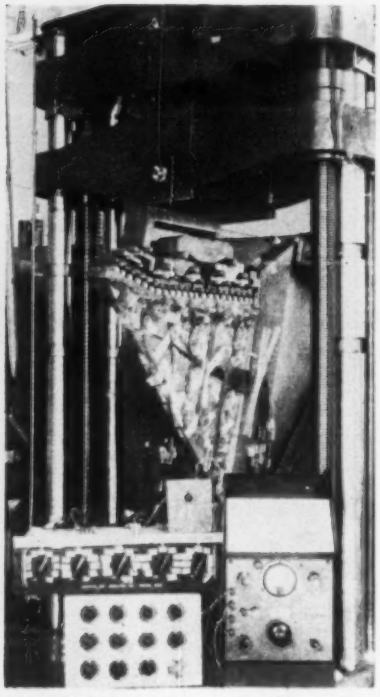
Another modification of the internal zoning is the use of selected, natural materials with transitional graduation in place of the more expensive thin filters having a precisely manufactured gradation.

Of equal importance in reduction of project cost is the increasing, optimum

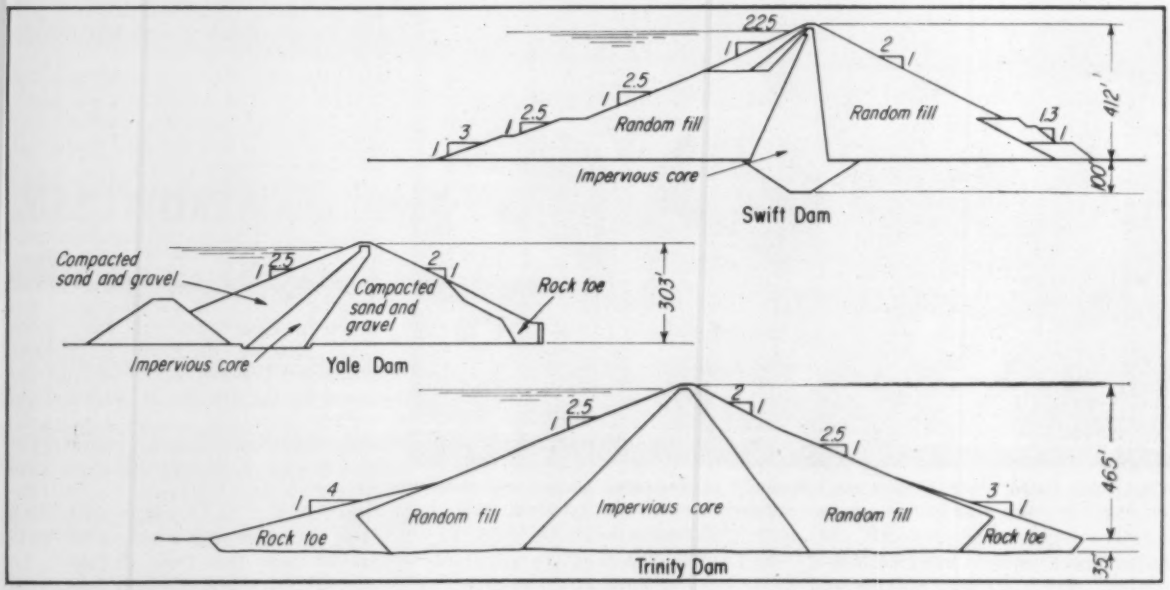
. . . Rockfills reach new heights, gain in number



NOTABLE MASSIVE BUTTRESS DAM, only one of its type in North America, Peligre Dam is under construction in Haiti. The 233 ft high structure is unusual in that the sluice conduits, penstocks and spillway are built into the flat-headed buttresses.



ALUMINUM MODEL for a 550 ft high buttress dam equipped with electric strain gages is loaded in a testing machine.

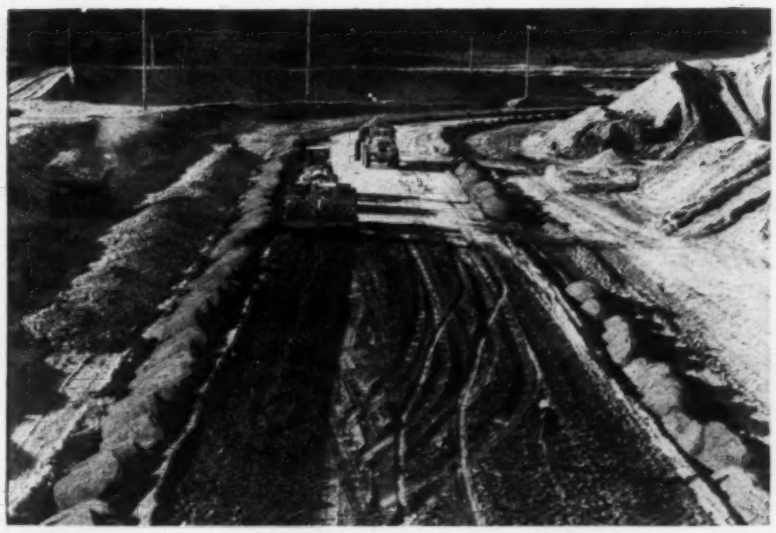


STEEPER EMBANKMENT SLOPES represent one of the advances resulting from modern earthfill dam design techniques. Trinity and Swift are under construction, and Yale was completed in 1953. Development of earthmoving equipment has affected earthfills.

utilization of available material. The significance of this advance is demonstrated by Swift Dam, which according to the designers became feasible only by utilizing the cheapest and most readily available materials.

Construction methods have played an important part in the evolution of designs. Prior to mechanization, larger volumes of fill were placed by sluicing or hydraulicking. The development of modern excavating, transporting and compacting machines has given the designer greater freedom in proportioning embankments and greater control over the construction materials.

The Corps of Engineers' Oahe Dam in South Dakota is now averaging placement of 100,000 cu yd per day with the use of 13-cu yd electric shovels, 35-cu yd rear dump trucks and 50-ton pneumatic tampers. Now they are experimenting successfully with a 30-mph 80- to 100-cu yd truck.



EARTH EMBANKMENT CONSTRUCTION at Priest Rapids Dam illustrates use of natural materials with transitional gradation in place of more expensive thin filter layers.

• **Rockfill dams**—The first notable advance in rockfill dams—the introduction of the articulated concrete face slab to replace the timber decking—is credited to the late L. F. Harza. His design for the 275 ft high Dix River Dam, Kentucky, completed in 1925, incorporated the concrete face and launched the rockfill type as a high dam. Shortly thereafter, I. C. Steele in his design for the 328-ft Salt Springs Dam, California, established a number of improvements in the concrete facing, and initiated the definition of criteria for rockfill construction. An alternative type of impervious facing, a 15 to 29 ft thick sloping blanket of compacted soil, was designed by J. P. Growden for the 260 ft high Nantahala Dam, built in 1942.

Recent notable rockfills have been the 425 ft high Mud Mountain Dam and the 320 ft high Watauga Dam, both built with impervious cores of compacted soil located centrally rather than on the upstream face.

A most significant improvement in rockfill dams is the reduction in settlement. After 24 years Dix River Dam showed a maximum crest settlement of 3.5 ft. But a rockfill dam with central core, the 430 ft high Ambuklao in the Philippines, designed by Harza Engineering Co., showed that, after the first cycle of filling and drawing down the reservoir, the maximum vertical settlement was only about one foot, less than one-quarter of one percent of the height.

The amounts of settlement have been reduced by employing very high dump lifts, by directing rock during placement in the same direction as ultimate settlement will move it, and by application of large volumes of jetted water at the time of rock dumping (2 to 3 cu yd of water per cu yd of rock).

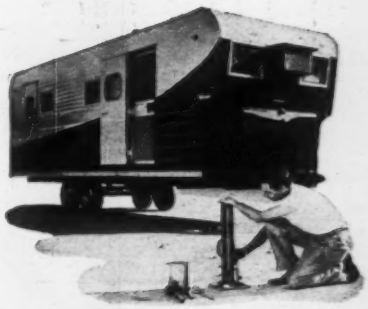
• **New concepts**—Many of the better damsites have been developed; the more difficult remain. More and more, storage requirements rather than site characteristics are governing site selection. Economy is increasing in importance. Originality of conceptions is essential, composite structural types and new structural applications are emerging. A few examples will illustrate.

Going back 30 years, Rodriguez Dam in Mexico involved a troublesome 100 ft wide fault in the streambed where the dam achieved its maximum height of 267 ft. The Ambursen engineers solved the problem by spanning this fault with an arch, which supported the four highest buttresses, and transferred the entire weight of the dam and the water loads to sound rock each side of the fault.

The same principle was applied recently by Harza Engineering Co. to the design of the main spillway dam of the Box Canyon hydro-electric project on the Pend Oreille River in Washington. Here a 150 ft wide gorge, extending below the present river level for a depth of about 200 ft, was spanned by a concrete arch that supports the main spillway weir and piers. The first essential at Box Canyon was to design a structure that could be built in one low-water season. The arched foundation structure provided a means for starting to build out of the river just as soon as the streambed was reached. The design provided a comfortable margin of time for construction. Actually, Morrison-Knudsen, the contractor, completed the work well ahead of schedule.

Different, and yet basically similar, is the solution of a problem on the Cowlitz River in the state of Washington. Mayfield Dam, a 220 ft high arch de-

(Continued on page 92)



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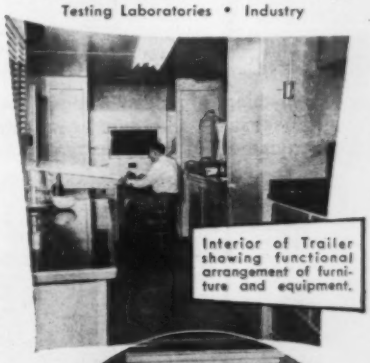

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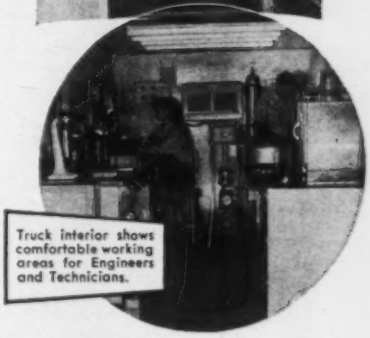

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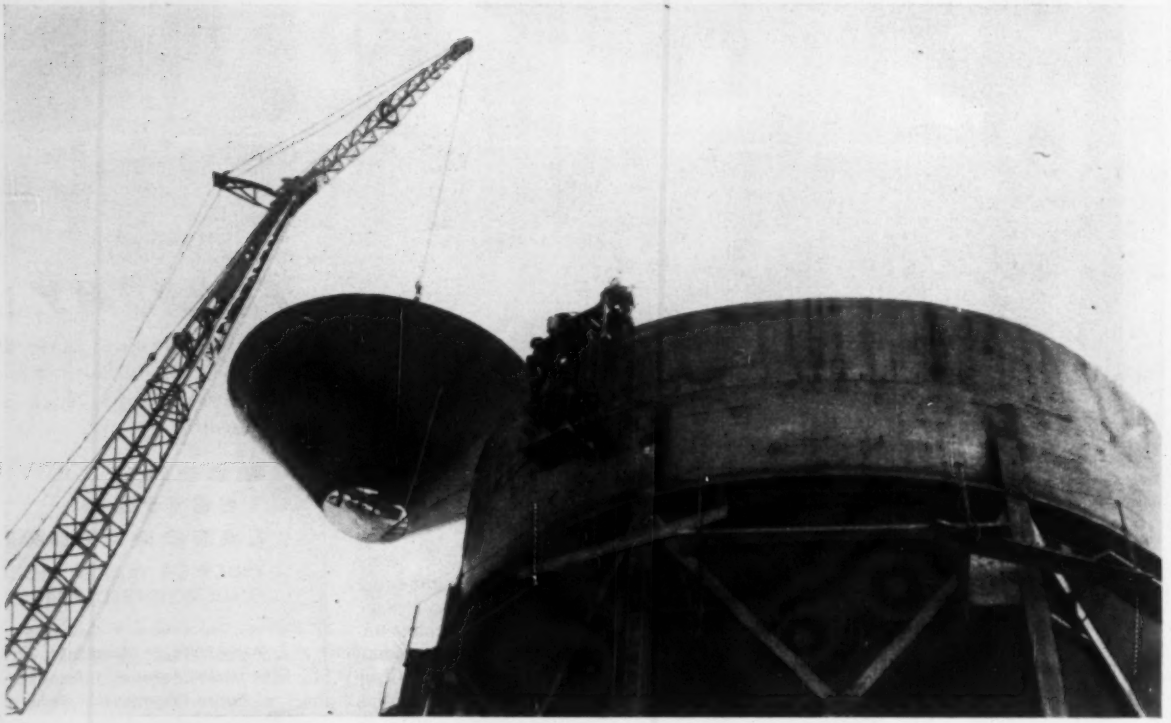

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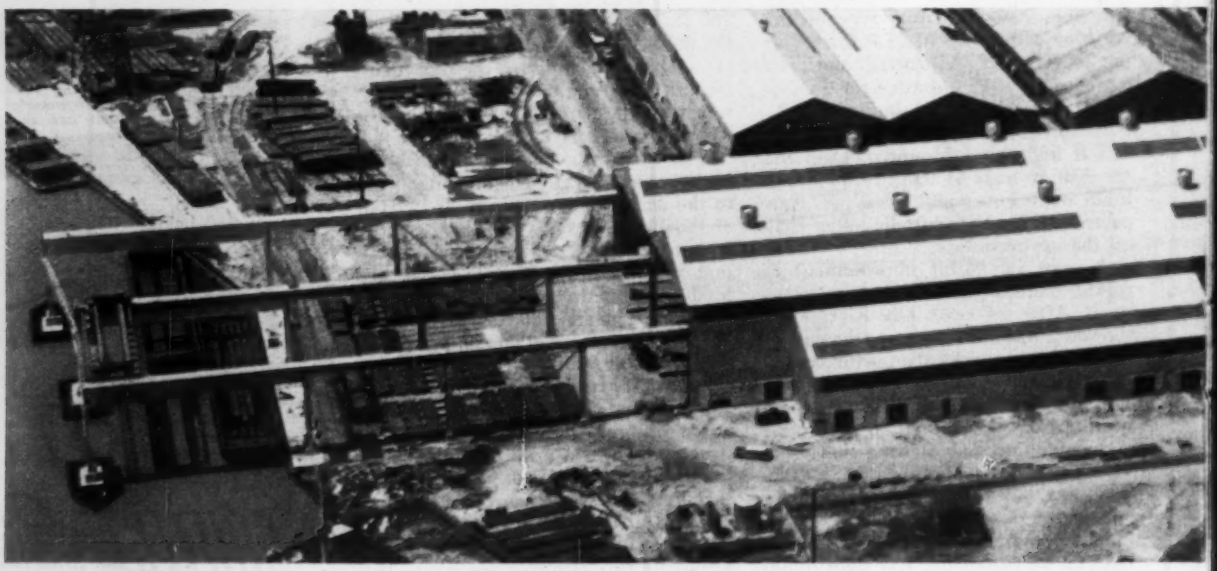

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To better accommodate the growing needs of the dynamic industries of the South and Southwest, our Orange, Texas, plant has been completely modernized, enabling us to handle literally any type and size of plate work—including heavy wall pressure vessels for the petroleum, chemical, paper and other industries.

Plate fabricating facilities include large car bottom-heating and stress-relieving furnaces, high-capacity bending rolls, a variety of presses and press brakes, the latest in welding and X-raying equipment, high-capacity plate shears, edge planers, boring mills and drills.

The plant, strategically situated to serve the industries of the South and Southwest promptly and economically by rail, truck or water, is also designed for fast, efficient material handling. It is equipped with 7 cranes capable of lifting over 100 tons.

American Bridge also offers complete construction service. We have the experience, manpower and equipment to handle any plate construction work efficiently and economically.

Our Orange plant is ready to serve you now. Specialists at Orange and all other American Bridge Contracting Offices around the country are prepared to discuss your plate requirements. For high-quality, economical plate work, just get in touch with the nearest office.

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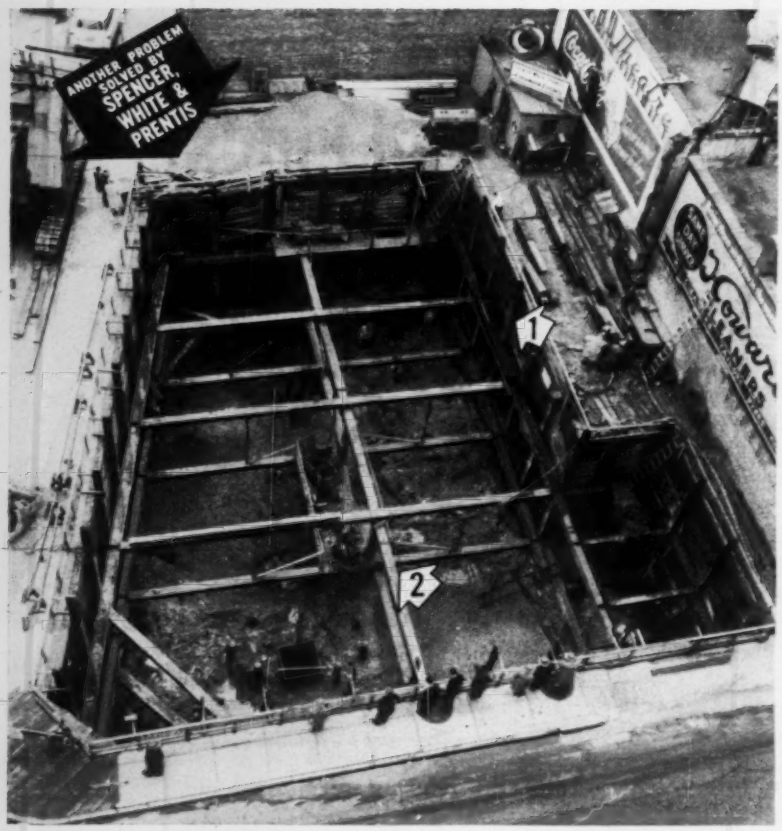
American Bridge Division of USS United States Steel



HANDLE DEEP WET EXCAVATION WITHOUT STEEL SHEETING

1. SOLDIER BEAMS AND HORIZONTAL WOOD SHEETING
2. TWO TIERS OF CROSS-LOT BRACING
BOTTOM OF EXCAVATION 30 FT. BELOW CURB

Project: Sewage pump station and office building for Hampton Roads Sanitation District Commission
Engineers: Buck, Seifert & Jost, New York City
General Contractor: W. F. Magann Corp., Portsmouth, Va.

In the center of downtown Norfolk, just a few blocks from the waterfront, a deep and unusually difficult excavation was required, in wet clay, sand and silt, almost entirely below ground water.

In view of much past experience in the area, it was assumed that steel sheeting would be required. Photo shows how the problem was solved successfully—and economically—with the use of soldier beams and horizontal wood sheeting.

Existing electrical utilities and buildings, which added to the complexities of the job, were in no way disturbed.

Perhaps our 40 years experience handling difficult foundation work can be helpful to you.

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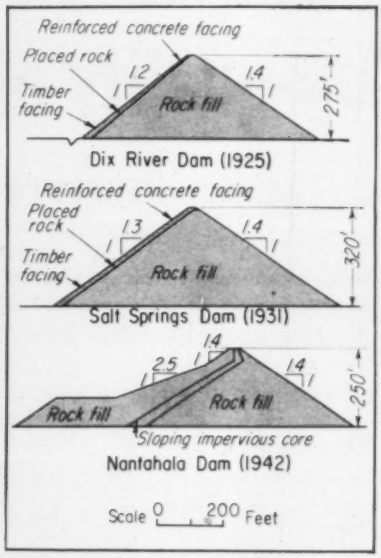
. . . Spillway design



MAXIMUM CROSS-SECTIONS of rock-fill dams that have introduced notable advances into U. S. practice for this type.

signed for the City of Tacoma, spans a 110 ft wide gorge. Forces from the upper two-thirds of the arch are taken by thrust blocks. In the lowest third, the arch abuts the gorge walls. The rock in the gorge walls is sound, but with extensive jointing parallel to the gorge. The problem of assuring resistance in the gorge walls at least equal to that of the thrust blocks above will be solved by specifying grouting and post-tensioning with long rock-bolts. This forces the rock abutments to form an internal arch extending through the critically jointed zone. In this instance a rock and concrete arch spans the zone of questionable support.

Peixoto Dam in Brazil is another notable structure of this general type. Peixoto consists of a gravity intake dam 585 ft long on the left bank, a gravity spillway section 535 ft long on the right bank, and a 615 ft arch between, with its thrust blocks abutting the gravity dam sections.

Examining the Peixoto design one might ask: Is the next step a multiple-arch dam with arch spans ranging between 500 and 600 ft for dams in the 200 to 1,000 ft height range? And will this be the end result of the notable advance started by Olberg and Noetzli in designing Coolidge when spans were increased from 60 to 180 ft? The writer believes that the answer to these questions is yes.

• **Spillways**—No general discussion of dams would be complete without mention of spillways which are so often an

(*Continued on page 97*)

Look ahead ...*move ahead* ...and stay ahead with Allis-Chalmers crawler tractors

first choice on more and more tough jobs

Four big advantages stand out in the coast-to-coast swing to Allis-Chalmers crawler tractors:

- **outstanding work capacity**
- **real dependability under severe conditions**
- **easy maintenance and lubrication**
- **timesaving, cost-cutting service**

As a result, Allis-Chalmers users bid closer to the belt, set schedules with more confidence, end up "in the black." So before you buy your next tractor, take a close look at *these* machines . . .

There's an extra measure of

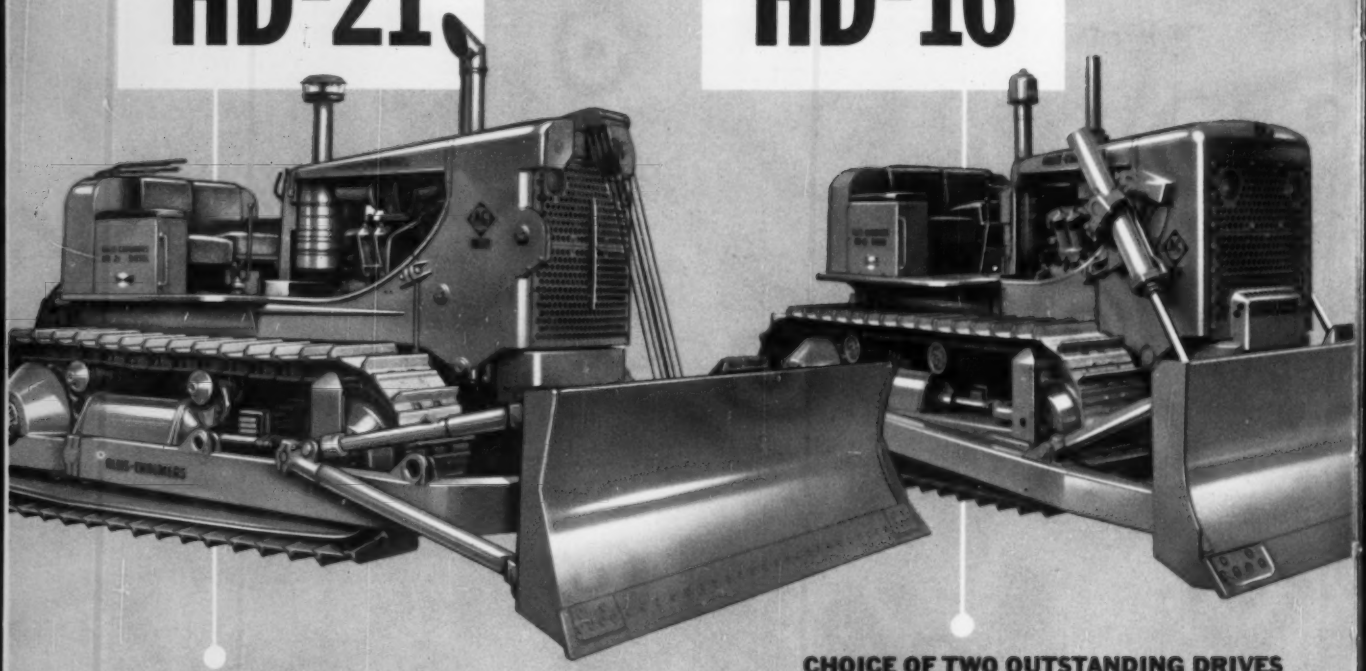
IN EVERY SIZE . . .

ALLIS-CHALMERS

HD-21

ALLIS-CHALMERS

HD-16



225-hp turbocharged engine
Hydraulic torque converter drive
56,260 lb (approx. as shown)

The new HD-21 brings you live power for today's big-tractor jobs—and torque converter drive puts it to work automatically. The HD-21 offers more work capacity—dollar for dollar—than any other big crawler tractor you can buy.

HD-21A illustrated—Two other models available

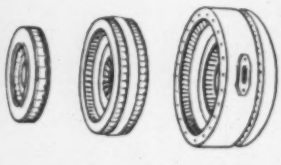
CHOICE OF TWO OUTSTANDING DRIVES

Hydraulic torque converter	All-gear
150 net engine hp	141 belt hp
39,090 lb (approx. as shown)	125 drawbar hp

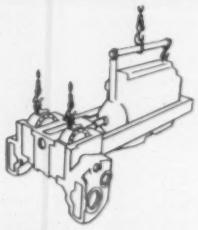
Get up on the HD-16 yourself—and see how it handles jobs ordinarily assigned only to bigger, more expensive crawler tractors. You'll sell yourself—just as more keen-eyed construction men do every day.

HD-16DC illustrated—Five other models available

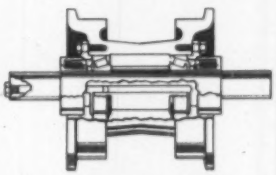
Pioneered and proved by Allis-Chalmers Engineering in Action



Torque Converter Drive gets more work done—automatically provides the right pull or push for every load, at maximum speed for existing conditions. *(Available in HD-21 and HD-16 only.)*



Unit Construction saves valuable time . . . lets you remove any major assembly without disturbing adjacent assemblies.



1,000-Hour Lubrication intervals for truck wheels, idlers, support rollers . . . changes daily greasing time into production time.

THE ONLY COMPLETE LINE OF CRAWLER TRACTORS THAT

performance and dependability

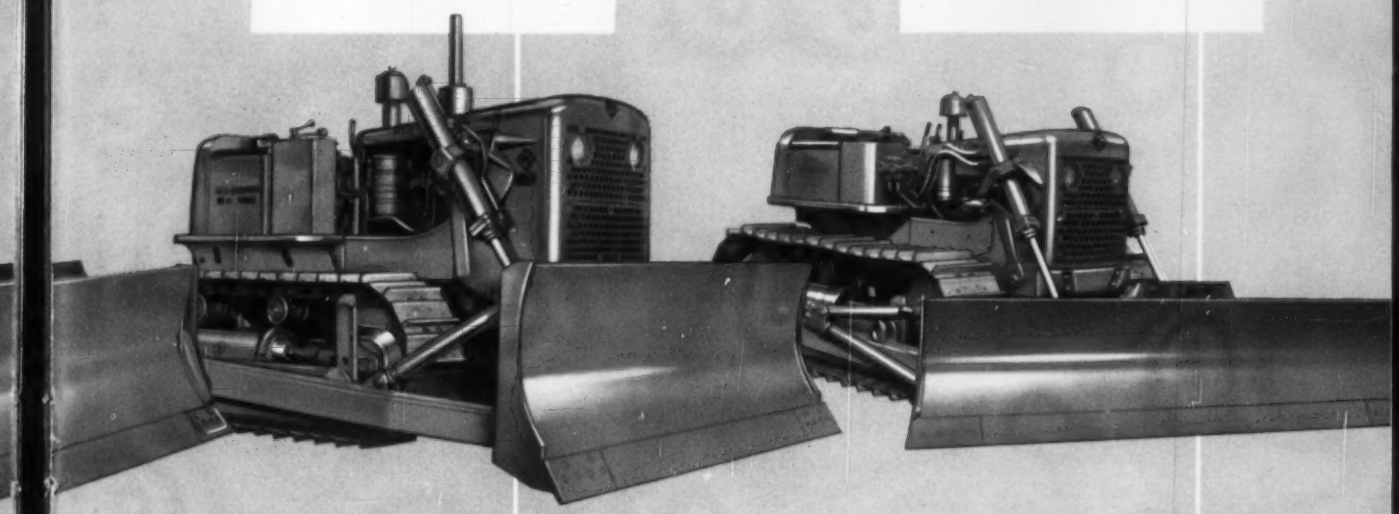
. . . A SIZE FOR EVERY JOB

ALLIS-CHALMERS

HD-11

ALLIS-CHALMERS

HD-6



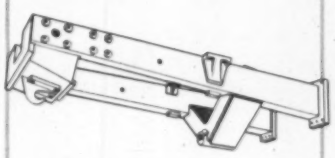
94 belt hp
25,960 lb (approx. as shown)

The HD-11 is setting new standards in its size range . . . offers you dozens of work-boosting advantages, including the industry's easiest shift pattern. A single shift takes it from any forward speed to any reverse—gets short-cycle jobs done faster, easier.
HD-11B illustrated—Two other models available

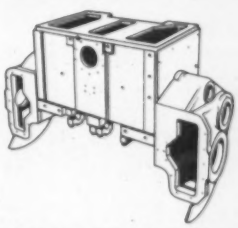
63 belt hp
16,470 lb (approx. as shown)

Here's up to 15,500 lb drawbar pull. The HD-6 is the only tractor near its size with big-tractor design advantages—for example, All-Steel Box-A main frame and engine-mounted dozer with direct-lift cylinders for improved weight distribution, accurate dozing and long life.
HD-6E illustrated—Three other models available

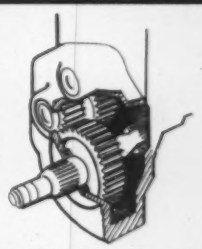
True-Dimension Track heat-treated and machined in the industry's most modern facilities, is setting new track-life records on every type of work.



All-Steel Box-A Main Frame soaks up shock and strain . . . provides improved weight distribution and equipment mounting.



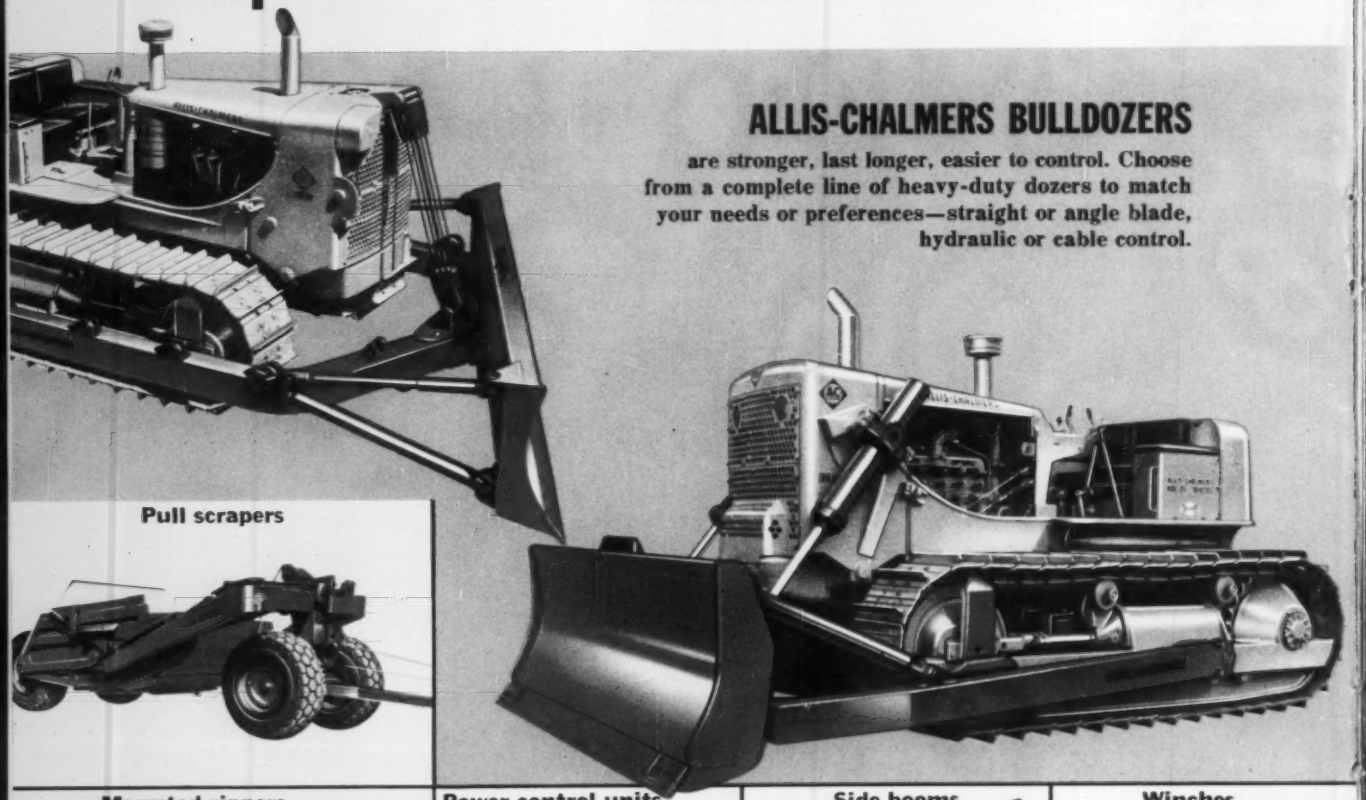
One-Piece Steering Clutch and Final Drive Housing with extreme rigidity and strength . . . line-bored to provide precise alignment of gears and shafts.



Straddle Mounting of All Final Drive Gears with tapered roller bearings on both sides of short, large-diameter shafts . . . provides extra gear life.

GIVES YOU ALL THESE ADVANTAGES IN EVERY SIZE..PLUS

a complete line of matched attachments

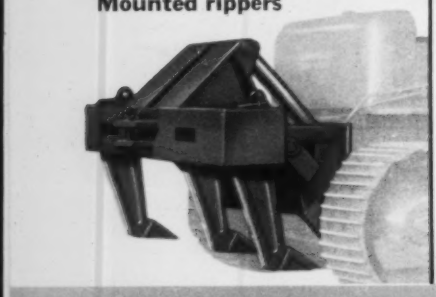


ALLIS-CHALMERS BULLDOZERS

are stronger, last longer, easier to control. Choose from a complete line of heavy-duty dozers to match your needs or preferences—straight or angle blade, hydraulic or cable control.

Pull scrapers

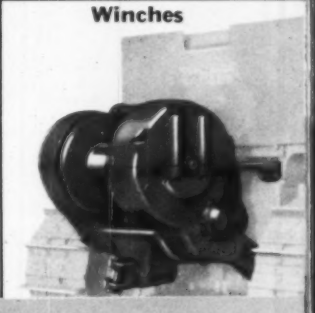
Mounted rippers



Power control units

Side booms

Winches



A demonstration on your job will prove their value . . . call your Allis-Chalmers dealer now.

Look ahead...*move ahead*...and stay ahead

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

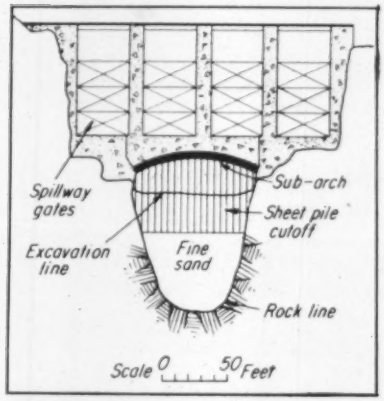
ALLIS-CHALMERS

FORM MS-1303

LITHO. IN U.S.A.

. . . The U. S. construction

(Continued from page 92)



SUPPORTED ON AN ARCH over a deep sand-filled gorge, Box Canyon Dam is an example of using a poor damsite.

integral part of the dam. Crest gate sizes are increasing, with 50 ft high tainter gates becoming more common and 65 ft high gates being designed, as at Wanapum Dam on the Columbia River. Chute type spillways with highly concentrated flows per foot of crest gate width are being adopted on projects in narrow valleys where the dam structure is not suited to supporting the spillway structure. Use of tunnel spillways seems less frequent, although the U. S. Bureau of Reclamation is supplying them at Glen Canyon.

The central objective of spillway design continues to be a low cost, reliable, safe means of destroying vast amounts of energy. Continuing emphasis on mixing the flood discharge with air and/or water in a stilling pool indicates the inherent economy and safety of this method.

Free-fall spillways of high capacity over arch dams have yet to receive wide acceptance among American engineers.

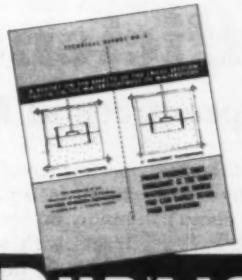
Outlet valves continue to be used on many dams, the most popular types in recent years being hollow jet or Howell-Bunger type.

• **In conclusion**—The trends over the last 30 years are easily charted by examining the evolution of designs as evidenced in structures and their performance. Less easy to define, but of even greater importance, is the evolution of design philosophy that must precede any design modifications. For this reason we have paid homage to Noetzli, not because he designed and built many structures, but rather because his design philosophy, recorded more than 20 years ago, has sparked the advanced thinking of many designers, and even now is the inspiration for future advances.

NOW...YOU CAN SOLVE YOUR WATERSTOP PROBLEMS IN A SCIENTIFIC MANNER

In the past, smooth surfaced waterstops have been used in concrete structures in the belief that they will effectively eliminate leakages resulting from water percolation around the waterstop. It has been a common practice to specify 6" waterstops for "small jobs" and 9" waterstops for "big jobs" . . . this practice was not based on the results of any scientific analysis. A series of tests have now been conducted by the Ontario Research Foundation in order to determine how the functional performance of DURAJOINT Waterstops, 4" and 6" wide, will compare to the functional performance of Dumbell Type Waterstops, 6" and 9" wide, when embedded in concrete and subjected to hydrostatic pressures of various magnitudes.

The tests provide positive proof that it takes the right combination of PVC material and multiple-ridge cross section design, found only in DURAJOINT, to stop water under all joint conditions that are likely to exist. The tests also proved that the 4" wide DURAJOINT Waterstop is far more effective than the 6" wide Dumbell Waterstop and the 6" DURAJOINT Waterstop is also far more effective than the 9" wide Dumbell Waterstop.



Be sure to investigate these interesting results yourself...send the coupon (below) today, for your free copy of the NEW DURAJOINT Technical Report No. 4. Contains complete technical data, graphic illustrations as to how the performances of waterstops compare, and actual copies of the test reports. If you are interested in waterstops, this report should prove to be one of the most interesting technical manuals you've ever read.

DURAJOINT TECHNICAL INFORMATION Center
121 HILL AVENUE • AURORA, ILLINOIS

Gentlemen: DEPT. 16

☐ Please send, without obligation, my free copy of Technical Report No. 4.
☐ DURAJOINT Catalog No. 457.
☐ Have representative call.

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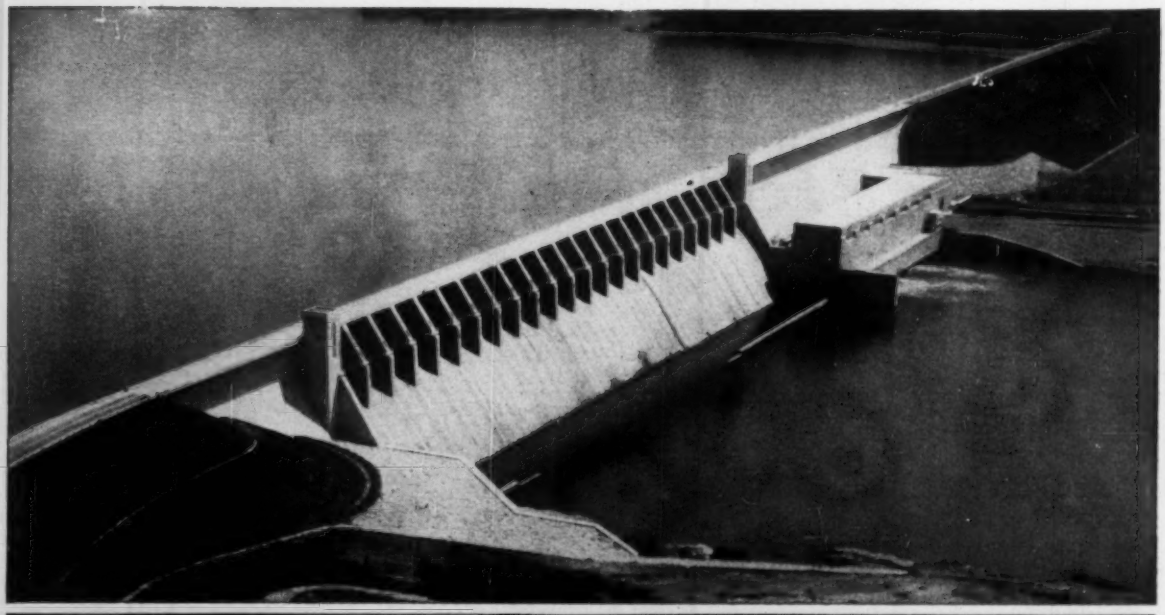
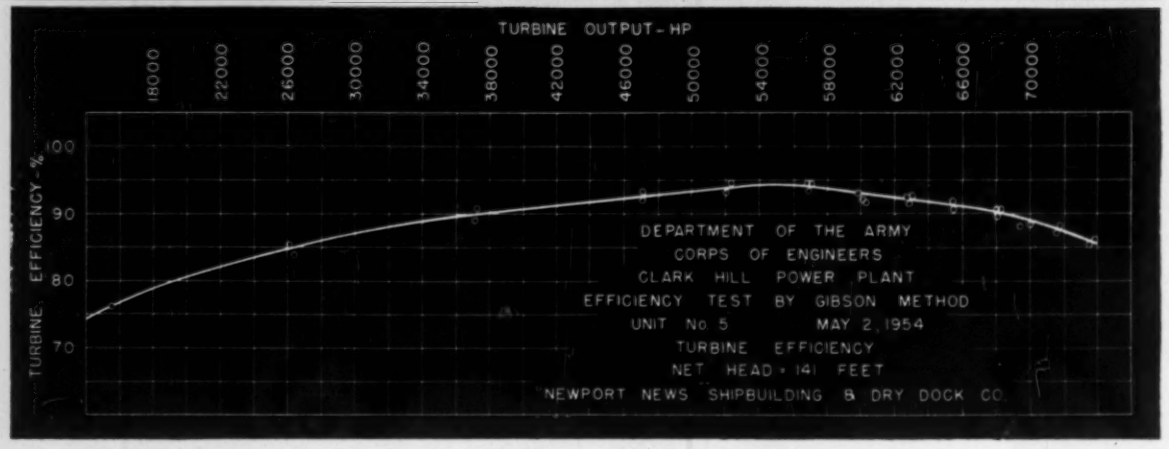
CITY_____ STATE_____





Maximum efficiency of 94.1%

Reflects advanced practices at Newport News

THE GRAPH shows performance of a 55,000 horsepower turbine, one of seven such units built by Newport News for the Clark Hill Power Plant (see photo).

Shape of the curve is typical . . . not exceptional . . . for Newport News turbine performance. Regular, uniform, showing no-cut-off at full load, it indicates consistent delivery and stable operation.

And especially, experience in design and model testing.

At Newport News, turbine runners are continually being designed and redesigned for improvements in performance. And often upon receiving a contract for turbines, a model setting is built and complete tests made. So far, Newport News has filled turbine contracts with an aggregate rated output in excess of 7,000,000 horsepower.

Penstocks, spiral casings, valves, pumps, rack rakes and other essentials are also designed and built by Newport News. Our illustrated booklet, "WATER POWER EQUIPMENT," will be sent to you upon request.

Engineers . . . Desirable positions available at Newport News for Designers and Engineers in many categories. Address inquiries to Employment Manager.

Newport News

Shipbuilding and Dry Dock Company
Newport News, Virginia

Big Savings: Mechanizing Paperwork

A xerographic photocopier, teamed with an offset duplicator, is saving at least $120,000 a year in paperwork costs for the New York State Department of Public Works. The biggest savings are realized in production of highway plans and specifications.

The state values the method so highly that it awarded $2,000 to the man who suggested the idea, Frank W. Springsteen, senior planning delineator. It was the largest award that has ever been made by the department for a suggestion.

The xerographic process employs a machine that electrostatically "photographs" written, typed, printed or drawn material. The image is processed and transferred to a paper or metal "master" suitable for offset printing. Because the photocopier uses a camera lens, the image can be reduced or enlarged.

• **A centralized service**—The state's xerographic installation, supervised by Mr. Springsteen, is part of the bureau of office services. The public works department uses it for many copying jobs as well as highway documents. An average of 1.2 million impressions are made each month and less than 300 from each offset master. About 85% of the material is for use within three days.

There have been other returns besides the $120,000 savings since the department switched from conventional blueprinting and mimeographing. Legibility is better and filing space and paper costs have been reduced.

A major benefit is that engineering drawings now can be produced in easier-to-handle sizes, which is one reason for a noted 25% increase in demand for highway plan reproductions. The half-size, yet legible, reproductions are easy to carry and consult in the field.

Two kinds of xerographic equipment are used by the state. Both are rented from the manufacturer, Haloid Xerox, Inc., of Rochester, N. Y. One unit reduces documents as large as 18x23 in. to 8½x13 in. on 10x15 in. paper masters. This setup costs $120 a month. The second unit reduces outsize documents of up to 24x36 in. to 12x18 in. on a 15½x20 in. offset paper master. This model is used for highway plans and costs $750 per month for the entire installation. If the equipment is purchased, the smaller model costs $4,000, and the large unit costs $30,000.

• **How it works**—In the past, the bidder filled in by hand the bid areas of specification books, containing from 5 to 300 pages. The state then removed the pages, cut new stencils by typewriter, proofread the figures and ran off 35 copies per bid. The pages were then reinserted in the book.

Now the pages with the bidder's figures are copied by xerography and the 35 copies run off on an offset duplicator. Proofreading and cutting of stencils are unnecessary. About 50 manhours per contract are saved, or over 20,000 manhours for the 400 contracts handled by the department each year. Figured at $1.50 an hour, labor economies are placed at $30,000.

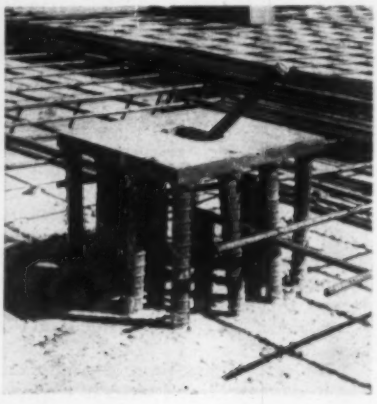
Another saving, estimated at $24,000 a year, is obtained by preparing preprinted breakdown sheets for the specifications booklet. These sheets, listing the bidder's estimate next to the state's, formerly were prepared from the typewritten stencils. Because the state's figures on a given project are constant, they are now reprinted on forms prepared by xerography, thereby eliminating the need for the retyping and proofreading step. Only the bidder's figures must be added.

The preprinting of constants also is

a cost-cutter for many types of periodical reports. Two other state departments use the xerograph installation to preprint monthly reports and save $3,000 a year each in stenciling and proofreading costs.

• **Other savings**—The xerographic process permits copying both sides of a sheet of paper, an operation that saves the public works department $5,000 in materials costs on the 400 contracts it sends out annually. Moreover, the contracts are reduced to about one-sixth of their former weight. That means 75% less postage, an annual saving of more than $15,000 to the department. In addition, machine-collating instead of hand-collating is possible because documents can be reduced in size. This eliminates about $18,000 in costs per year.

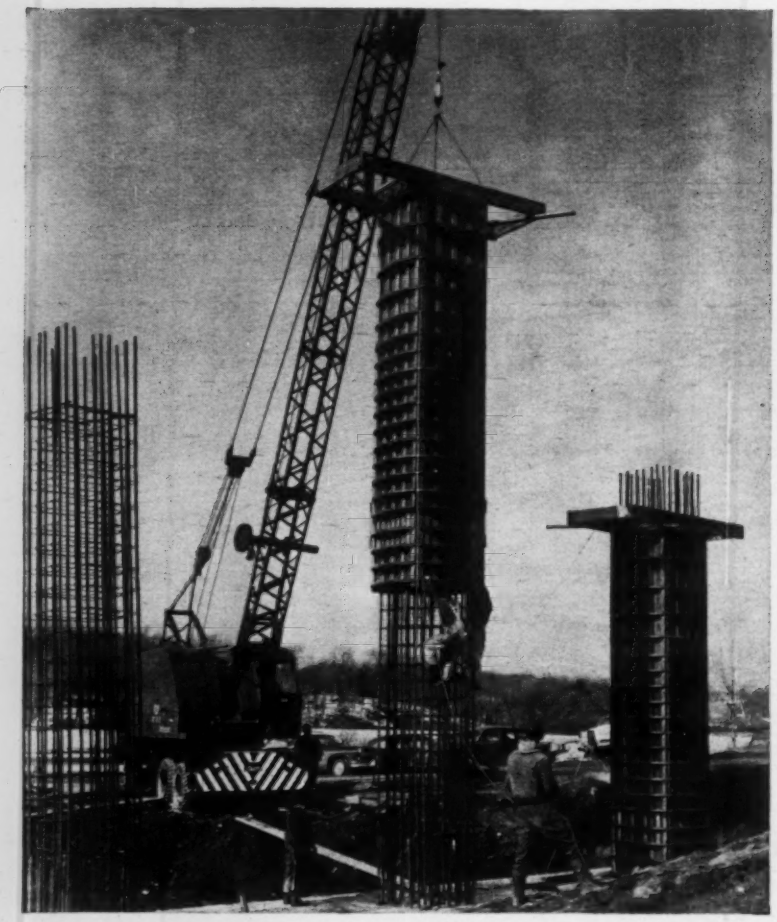
The department saves in a number of smaller ways too. Record copies of the half-size prints take up less storage space, relieving pressure on the department's filing space. The xerographic process makes short-run printing of forms economical, cutting the space needed for storing forms. Finally, regular drawing paper may be used for originals instead of costly linen or vellum.



Boltless Column Base Gives Full Continuity

Full continuity is provided between concrete and steel portions of a Hayward, Calif., building by a steel column base plate detail that eliminates anchor bolts. The detail involves welding a steel plate to column reinforcing bars. This assembly is cast into the floor slab. And the steel column later is welded to the plate.

Worked out by San Francisco structural engineers Pregnoff & Matheu for a Sears-Roebuck store, the column-base



Signode way saves 1/3 of form tying costs

Contractors tying forms with steel strapping are saving as much as 33% in labor and material costs. Signode strapping eliminates form hardware...is easily cut to length from the coil...is tensioned and sealed with tools one man handles readily...is stripped and disposed of quickly when forms are removed ...produces clean work that practically eliminates finishing time. And it is useful for many bundling jobs on the construction site. The Signode man near you is ready to help you cut form tying costs on your next job. Call him today, or write Signode.

Concrete column calculator simplifies form design

Your guide to proven, economical designs for concrete column forms. Shows strap sizes and spacings to use on forms up to 65" diagonal or diameter...illustrates six tested truss designs. Offer limited to architects, contractors, engineers. Mailed promptly on receipt of $1.00.

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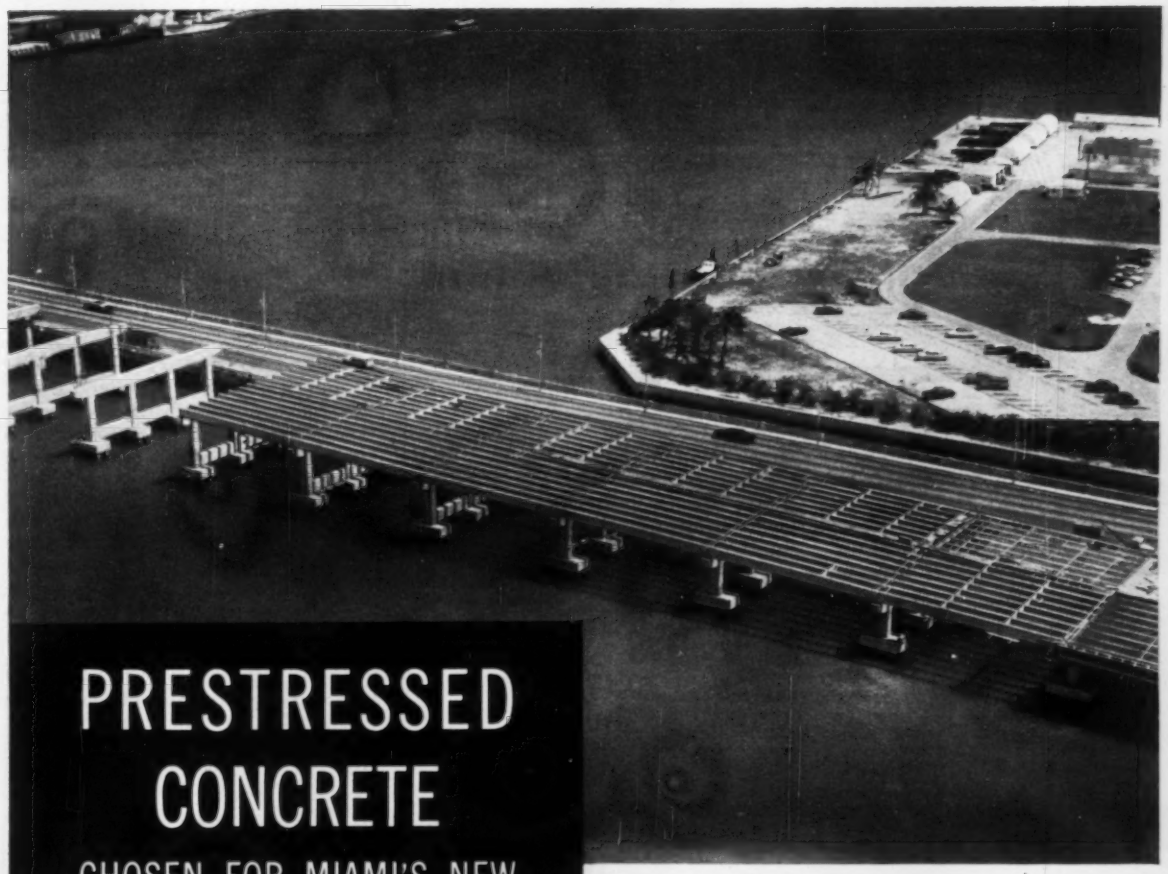


PRESTRESSED CONCRETE

CHOSEN FOR MIAMI'S NEW MacARTHUR CAUSEWAY

About 32,000 vehicles will use this bridge daily. Two fifths of a mile long and 86′ wide, it contains 536 beams 65′ and 45′ long, and 35,315 feet of 20″ x 20″ prestressed piling.

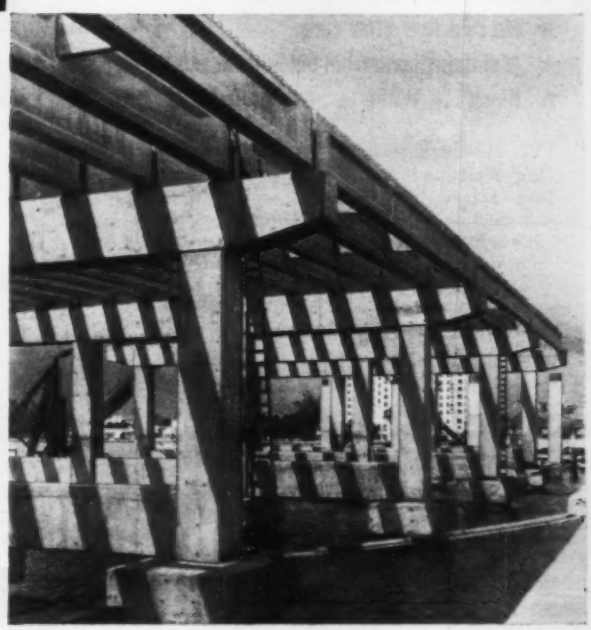
• With Florida's astounding growth of recent years, an old structure linking Miami with Miami Beach had, with its drawbridge span, become annoyingly inadequate.

To replace it, the Florida State Road Department chose a fixed span bridge of prestressed concrete. *The ease of construction, low initial and maintenance costs, and sleek modern appearance of prestressed concrete* were the deciding factors.

In the manufacture of the prestressed beams and piling, R. H. Wright & Son used Lehigh Early Strength Cement for maximum production efficiency. The units were completed quickly, ready for trucking to the job site as needed.

This is another example of the use of Lehigh Early Strength Cement in modern concrete construction.

Owner: Florida State Road Department
Contractor: Heavy Constructors, Inc., Miami and Ft. Lauderdale, Fla.
Prestressed Units Manufactured By: R. H. Wright & Son, Ft. Lauderdale, Fla.



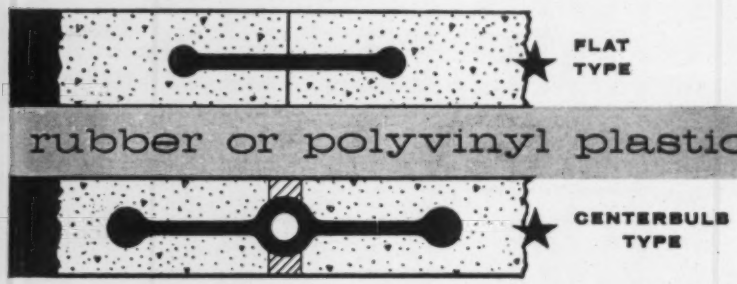
LEHIGH PORTLAND CEMENT CO.
Allentown, Pa.

SERVICISED

DUMBBELL DESIGN

WATERSTOP

for Watertight Concrete Joints



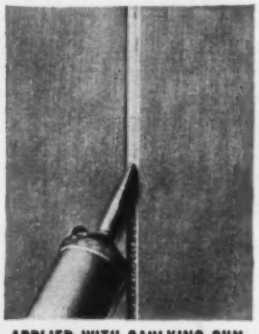
Servicised Dumbbell design has been used for more than 25 years in heavy concrete structures and where hydrostatic water pressure is present because it provides better retention of the waterstop in the joint during horizontal or vertical movement. When concrete contracts and the joint opens up, outer dumbbell edges become more tightly engaged with the concrete, making it a tighter seal as the tension increases due to movement either in the joint or increasing water pressure on one side of the joint. Dumbbell design waterstop is made from rubber or polyvinyl plastic in both flat or centerbulb types. Write for special Catalog.

VERTISEAL

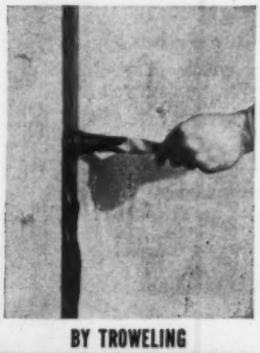
cold applied vertical joint sealer

★ Self-vulcanizing
★ No cold flow after cure
★ Maintains bond from below 0° to 150° F.
★ Black . . . White . . . Gray colors

Vertiseal is an extremely efficient joint sealing compound . . . resistant to petroleum derivatives, most common acids, fats and alkalis. Stable composition, superior cohesive and adhesive qualities, and simple installation with caulking gun or by troweling, make Vertiseal first choice for sealing virtually any type of vertical or horizontal joints.



APPLIED WITH CAULKING GUN



BY TROWELING

Write for special Vertiseal Catalog and Specifications.

SERVICISED PRODUCTS CORPORATION
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connection guarantees a positive moment connection. And this is important in an earthquake area.

The designers believe this connection is superior to the more conventional uses of anchor bolts—particularly since the base does not protrude above the floor slab. And by lapping the reinforcing bar stubs with the vertical column reinforcement below, full continuity is obtained.

A further advantage of this detail, according to the designers, is that smaller plates can be used. The reason is that the concrete immediately below the base plate is designed as a reinforced concrete column with a higher bearing stress than for conventional grout packing. Besides this, the base plate assembly with reinforcing bars transmits shear and moment directly into the floor slab as concreted. And the contractor can set these base-plate assemblies to elevation ahead of time to provide check points for floor finishing. The finishing of the detail, of course, offers the minimum loss of floor space.

Architect for the Sears-Roebuck store is Reynolds & Chamberlain, Oakland. General contractor is Hilp & Rhodes, San Francisco. Steel fabrication and erection was by National Iron Works, Alameda.

Forms Score Concrete To Hold Tiles Better

The telescoping steel forms being used to line Pittsburgh's Fort Pitt Tunnel with concrete have wires welded to the skin plates of their sidewall panels. The idea is to give the formed concrete surface a scored effect that will make it a better bonding surface. Mortar must bond to the concrete walls because they will be lined with tile.

Fort Pitt Tunnel is a vehicular tunnel on the Mt. Washington side of the Monogahela River. Its twin bores will carry traffic to the two-level, steel arch bridge over the river (also under construction at this time).

Using wires on the sides of the steel forms is not an entirely new idea. It was used on the Squirrel Hill Tunnel, also in Pittsburgh and on this same major east-west highway, the Penn Lincoln Parkway.

At Fort Pitt Tunnel, a 150 ft length of steel forms is to be used for the tunnel lining. Forms were assembled outside the portal in 50 ft lengths. On a jumbo inside the tunnel they will strip, collapse, and telescope to be reset ahead.

Merritt-Chapman & Scott Corp. is the contractor on the tunnel, and Blaw-Knox Co. is fabricator of the forms.

For the world's tallest dam... penstocks of Lukens "T-1" Steel

TRADE MARK

■ Minimum yield strength: 100,000 psi.

Impact strength: sustains Charpy tests at 15 ft.-lb., −50° F.

Weldability: manual or automatic, in the field as well as the shop.

Availability: immediate, and in the widest range of sizes available anywhere; 195" width, 720" length.

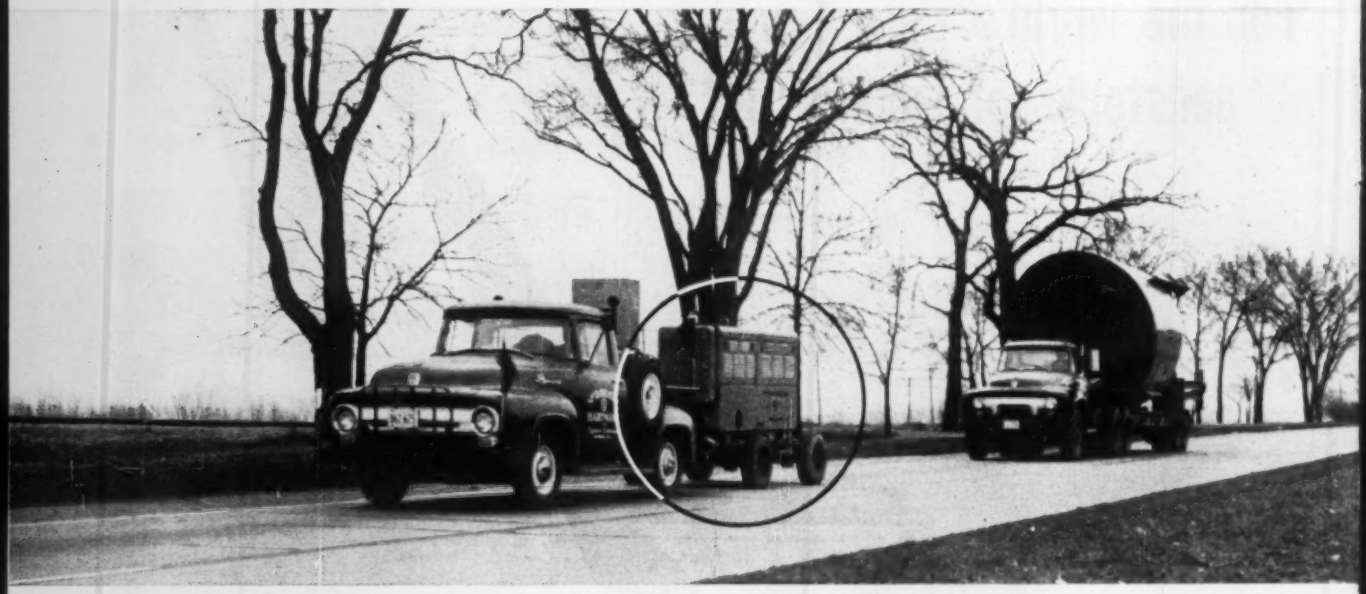
That's why the designers of Switzerland's Grande Dixence Dam specified Lukens "T-1" Steel for penstocks. And why this rugged, weight- (and freight-) saving steel is being employed in scroll casings for the Brownlee Dam, the Swift Dam, the Noxon Rapids Dam, and the Niagara Power Project.

Detailed information concerning this remarkable constructional alloy is contained in our new booklet, *Lukens "T-1" Steel.* For a copy, and other technical information, write Manager, Marketing Service, 159 Lukens Building, Coatesville, Pa.

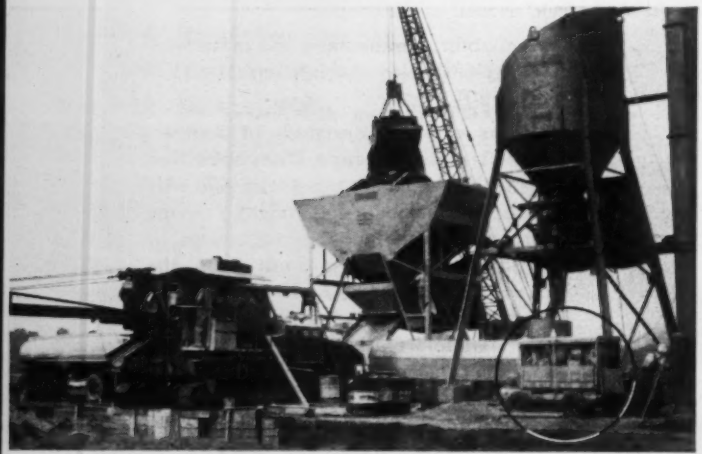
LUKENS STEEL COMPANY, COATESVILLE, PA.

World's Leading Producer of Specialty Carbon, Alloy, Armor & Clad Steel Plate • Heads • Plate Shapes • For Qualified Equipment Builders

Cat power saved these owners $1,300

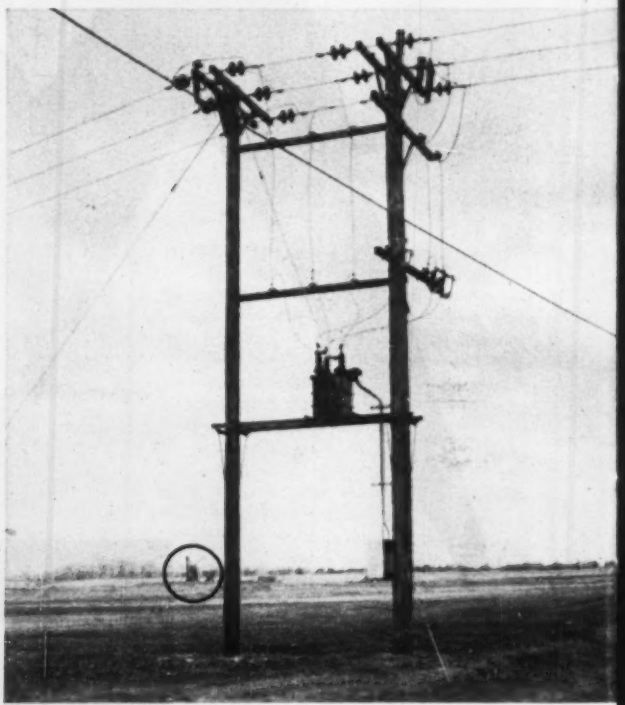


1 McDougal-Hartmann Co.'s, Heltzel Bin Hardy and Johnson Automatic Batching Plant follows their 40 KW Cat D315 Portable Electric Set to its fourth job site. Savings during the first year of ownership while moving them, alone have amounted to $3,900. Operational savings are not even included. The owners estimate that running in and hooking up to public utility power would have averaged at least $1,300 per move. An additional $1,200 was saved at the outset since the Electric Set would operate the plant's higher voltage electric motors which were supplied as original equipment.



2 At a previous job location in Sterling, Illinois, this unit produced 86.4 batches per hour for use on one of the firm's nearby road construction jobs.

Without portable power, it often requires the more common technique of setting up the batch plant along a railroad siding or right-of-way, bringing in materials by rail if the haul distance to the job is not excessive. Concrete specifications in some states limit the haul distance of mixed concrete due to the time element. All in all, Cat portable power saves operating time, cuts costs.



3 Many contracting companies with multi-state operations, such as McDougal-Hartmann, require power portability to avoid the frequent high cost and inconvenience of obtaining power in remote areas.

On their present job it would have necessitated stringing poles and wire from this power line to the plant location (in the circle). Instead, the highly mobile Cat Electric Set was rolled up alongside the batching plant, and hooked up with wall plug simplicity ready to go.

each time their batching plant moved

4 Performance and savings with this plant brought Mr. Jack Hartmann, Vice President (right), and Bud Moore, his C.D.E.S. (Caterpillar Dealer Engine Specialist), out to the job to plan a second batching plant installation. Satisfaction resulted in an order for a second identical Cat Electric Set for this contractor's expanding operations.

Mr. Hartmann remarked, "ABOUT ONE MORE MOVE AND OUR FIRST PORTABLE ELECTRIC SET WILL HAVE PAID FOR ITSELF IN SAVINGS FROM MOVES ALONE AND IN LESS THAN TWO YEARS. THAT WE LIKE TO SEE."

Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A.

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

5 The all-new, self-regulated generator for Cat Electric Sets is simple to operate. Voltage is adjustable from 5% above to 10% below nominal rating and regulated within 3½% of rated voltage. It has unsurpassed motor starting ability. Other performance features Mr. Hartmann liked were:

1. Low over-all cost per operating hour.
2. No down time due to power failure or engine failure.
3. No additional help required, due to the unit's simplicity and self-regulating standard equipment.
4. Advertised power produced and maintained.
5. His Caterpillar Dealer Engine Specialist, Parts and Service teams were on around-the-clock availability if anything went wrong. It didn't.

ENGINE POWER BY CATERPILLAR

If something has gone wrong with your present engine or it just won't produce in your excavator, crusher or other construction machinery, talk it over with your C.D.E.S. He can aid you profitably when repowering older machines or specifying engines for new equipment.

Engine Division, Dept. EN9
CATERPILLAR TRACTOR CO., Peoria, Illinois, U.S.A.

Send me more information about the new Caterpillar Portable Electric Sets. I understand that I am under no obligation.

☐ I would like more detailed information as I may be in the market for a Caterpillar Construction Engine.

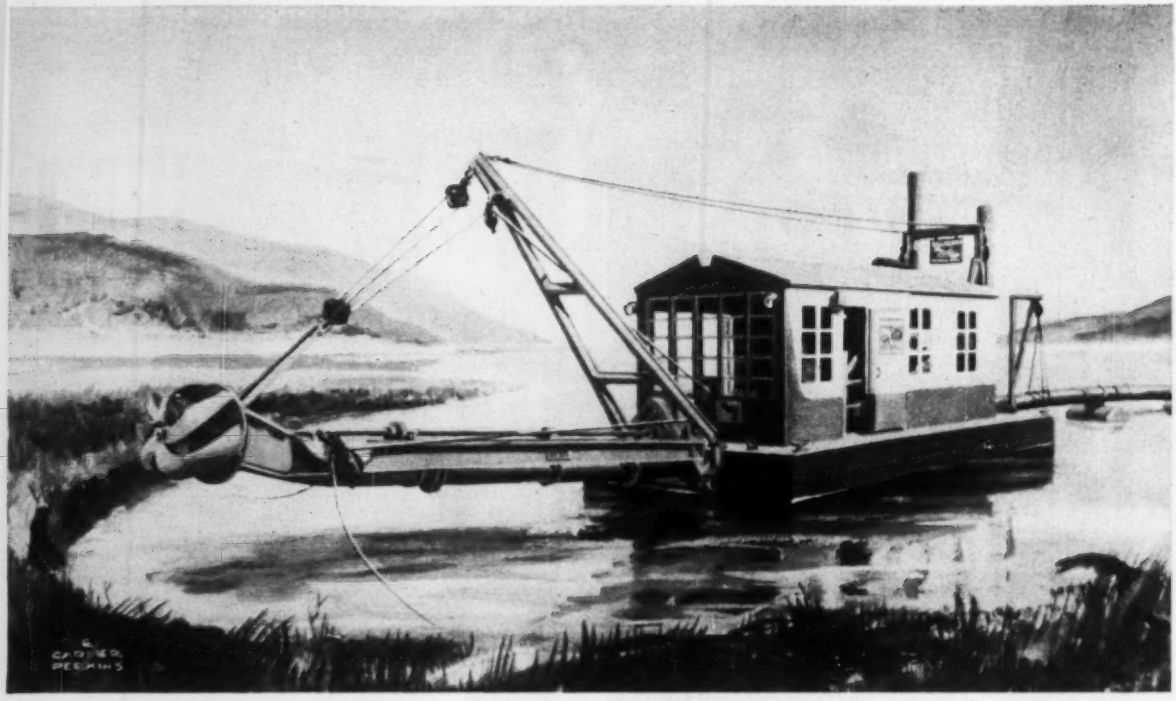
Name _____

Company _____

Address _____

City _____ *Zone* _____ *State* _____

New...Low Cost...Portable Ellicott Dragon*



easy to move from job to job . . . by truck or rail . . . match-marked parts for rapid field assembly

The new Ellicott 8" Dragon Model Dredge is a compact, high performance dredging unit. Like all "DRAGONS," this unit can be used for a variety of jobs . . . puts the outstanding economy of hydraulic dredging at your disposal for projects like road building, plant pond clearance and mosquito control. Or, for profitable development of new real estate from low-cost marginal land.

- **One Power Source** – 6 cyl. diesel engine with 142 shaft h.p. continuous rating powers Ellicott 8-inch heavy duty centrifugal suction pump, supplies power for hydraulically-actuated cutter and winch motors.
- **Rated Output** 85 cu. yds. per hour over 1,000 ft. pipeline.
- **Cutterhead and Ladder** dips as low as 17 feet below surface for fast, efficient digging of soft materials like sand, mud or silt.
- **2-Piece Hull** easy to transport and reassemble.
- **Heavy-Duty 8" Centrifugal Suction Pump** is simple, efficient, trouble-free.
- **Steel Spuds** "walk" the dredge through canals or waterways as work advances.

Learn how the new Ellicott 8" DRAGON can help you do more jobs better . . . at greater profit. Write for full information, today.

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Successors to the floating dredge business of the Bucyrus-Erie Co. and the American Steel Dredge Co. Complete engineering sales and repair parts service.

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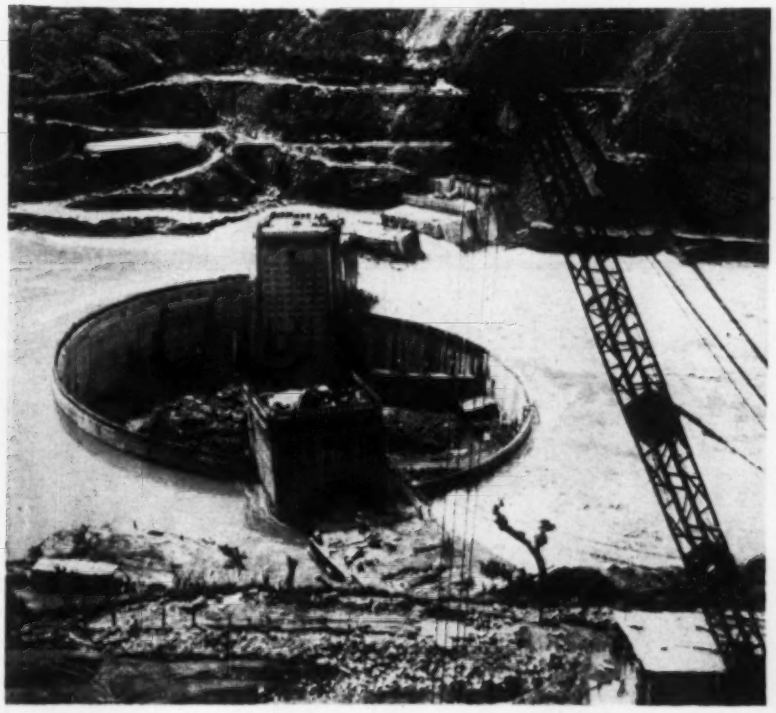

Kariba Cofferdam Is in Business

A 40 sq ft hole has been repaired and tons of river mud removed from the cofferdam at Kariba Dam that was breached during March's Zambezi River flood (ENR Mar. 6, p. 31). The builders of the huge 400 ft high arch in central Africa now hope to raise the main dam above this year's maximum water level before start of the 1959 flood season.

The 300 ft circular cofferdam was both topped and breached during the March flood. This was after the upstream half had been raised as a result of record water levels experienced during 1957. Zambezi River discharge at the Kariba site never exceeded 220,000 cfs in the years of record, 1947 to 1956. In 1957, 290,000 cfs swept past the dam, doing considerable damage.

Bad luck continued to dog the dambuilders during 1958. The March flood reached a discharge of 580,000 cfs. A final estimate of this year's damage is not available. Construction of the 1,300 ft portion of the 1,600 ft long dam outside the cofferdam resumed shortly after the flood, while work on the powerhouse downstream of the dam was never interrupted. Since only a 300 ft portion of the dam was affected, construction officials believe they can catch up with the original timetable by next January.

The Kariba contractor is Impresit, Ltd., of Italy. Owner is the Federal Hydro-Electric Board of Rhodesia.

Canadians Plan Pipeline For By-Products of Gas

An all-Canadian $80 million pipeline to carry natural gas by-products from Alberta to the Pacific Coast has been proposed by Foothills Products Pipe Line Ltd. Western Canada's manufacturing economy would get a boost of $300 million to $500 million, the company estimates.

No announcement has been made regarding detailed location of the 500 mile right-of-way, but the 12 to 16 in. dia pipeline would probably originate in southwest Alberta, run through Crowsnest Pass and terminate in lower British Columbia. It might carry sulphur in addition to liquid hydrocarbons, according to unconfirmed sources.

The company is reluctant to say more about the project now. It is believed in some quarters that the only reason

Prestressed Concrete Tanks Show Big Savings

Maintenance Costs Cut By 75%

Over a 50 year service life, a prestressed concrete tank will show a 75% saving in total maintenance costs over a steel tank of the same capacity. In today's economy, such a long range saving has tremendous appeal to municipalities and water companies throughout the world. When your tank requirements are in the planning stage, these calculated maintenance costs should be considered. Average yearly maintenance on a 3,000,000 gallon steel tank is estimated at $2500 per year at current prices. For a prestressed concrete tank, maintenance is negligible; however, occasional painting for color effect may be desired.

When the charges for servicing the initial cost plus relative maintenance allowances are plotted, the prestressed

concrete tank will often show a lower out of pocket cost to the owner in less than 5 years. When these costs and their increases are extended for an expected service life of 50 years, the savings to the owner with prestressed concrete are enormous.

The prestressed concrete tank is also a good looking tank . . . it is inherently strong and extremely stable . . . it is designed and built for permanence.

And, 75% of the contract price is spent right in your local community . . . construction is done with materials and labor available locally.

Write today for more information on Preload Prestressed Concrete Tanks.

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PRELOAD CONCRETE STRUCTURES, INC.
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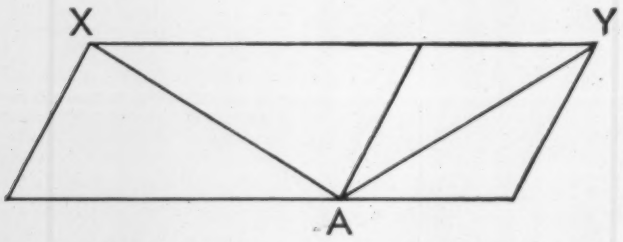
TRICKY TRACINGS

Can you tell, at a glance, whether AY is shorter than, longer than, or equal to AX? See answer below.



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No doubt about it! For flawless finish and lasting durability, Arkwright Tracing Cloths are in a class by themselves. Made to meet Government specifications, these quality-controlled cloths are completely free of pinholes, coarse threads and other imperfections which cause feathering or blobbing.

Roll after roll, you can count on Arkwright's superior working surface for crisp, clean drawings. You can depend, too, on its durable finish for permanent protection against fraying, tearing, curling or discoloration . . . for clean, accurate reproductions, even after repeated erasures. In the simple drawing above, the two diagonals are of equal length.

Ask for Arkwright — the roll with the blue line — the next time you need tracing cloth. Write for free samples today. **Arkwright Finishing Company, Industrial Bank Building, Providence, R. I.**

ARKWRIGHT
Tracing Cloths
AMERICA'S STANDARD FOR OVER 35 YEARS

it made any announcement was to discourage U. S. interests reportedly eyeing a similar venture. It has been suggested that the announcement will establish in the public mind the Canadian group's prior right to carry out the project, partly because the company's announcement is first and partly because of the all-Canadian nature of the undertaking.

Australians Move Ahead On $24 Million Hydro Plan

A $24 million scheme for a hydroelectric plant on the Barron River near Cairns in North Queensland, Australia, has been approved by the state. First power is scheduled for 1963. This project would operate in conjunction with the $30 million Tully Falls hydroelectric project, under construction.

An underground power station with an installed capacity of 60,000 kw is provided for at the Cairns project.

Another power project is being studied involving a 120,000 kw coal burning thermal station in Central Queensland to cost at least $25 million.

Brazilian Engineers Map Campaign on Sanitation

Fifty Brazilian sanitary engineers plan to launch a nation-wide sanitation crusade. They hope to convince government officials and the public of the importance of an extensive water and sewage works construction program.

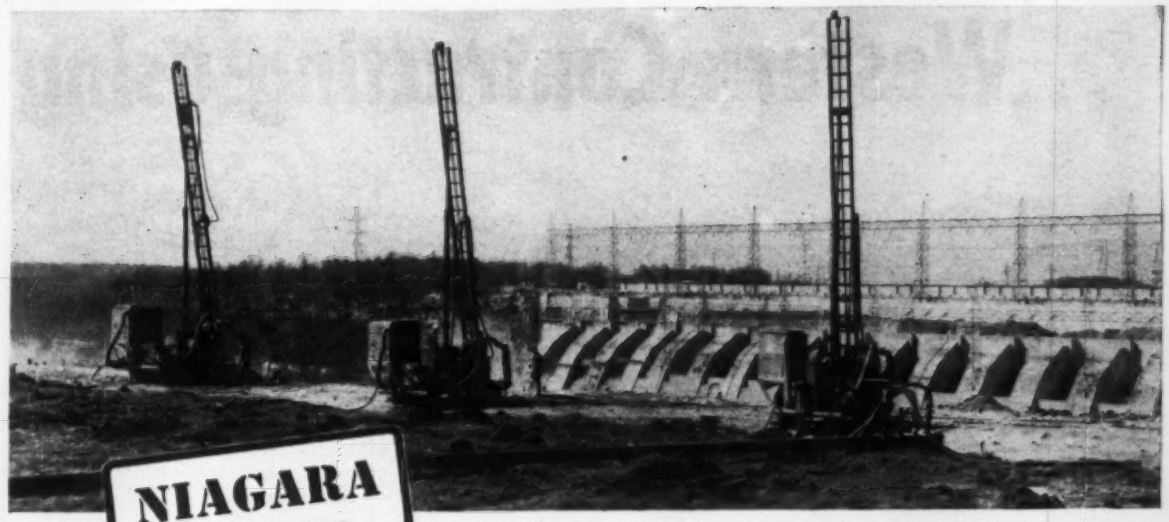
The group laid plans for a press-radio-mail campaign at a recent national seminar of sanitary engineering professors, to which a select group of government and professional engineers was invited. The meeting was sponsored jointly by the Ministry of Education, Public Health Service, University of Minas Gerais and the U.S. Operations Mission to Brazil.

Five-mile Tunnel to Cross Under Rio de Janeiro Bay

A call for bids can be expected soon for a vehicular tunnel to cross under Rio de Janeiro Bay from Rio to the city of Niteroi.

Advertisements for bids will be extended to France, Germany, Holland, England and Japan, as well as the U.S. Firms already reportedly interested in taking part in the project are Morrison-Knudsen, Stone & Webster Construction Co. and Raymond International.

The planned tunnel will be five miles long. Rio's bay is deep and on the Rio de Janeiro side the hilly terrain and urban concentrations will make access road construction difficult.

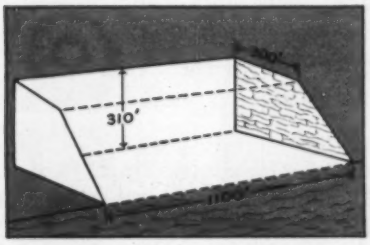


NIAGARA POWER PROJECT

Joy Challenger Drills Start Powerhouse Rock Job

Joy Challengers started drilling blastholes within 60 days after Merritt-Chapman & Scott was awarded the $99 million contract last February for construction of the main powerhouse of the Niagara Generating Plant at Lewistown, N. Y. The entire Niagara Power Project will cost $625,000,000.

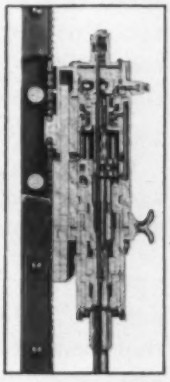
Here's the rock that must be moved



With 9,000,000 cubic yards of plant site rock to drill, M-C&S relies on Joy Challengers to get on with the CONSTRUCTION AHEAD. These Joy drifters drill 4" or 4½" diameter holes 30' deep without a steel change. Drill cycle speed and smooth operation proved Joy the best for the job.

Joy TM-500 Drills go deep

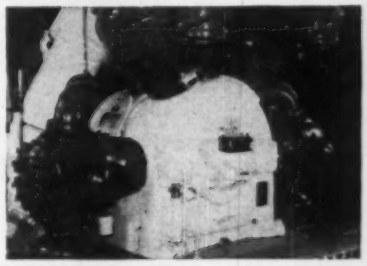
The guts of the Joy Challenger is the rugged 630 lb. TM-500, a 5¼" bore drill that combines power-packed punch and rotation with outstanding hole cleaning ability to bottom deep blastholes with ease. Features of the TM-500 include:



Force Feed Lubrication of all rotating parts.

Exclusive Joy Dual Valve for positive air control on up and down stroke of the piston.

Replaceable Bushings at all wearing surfaces including the chuck.



Joy WN-224's Supply the Air

Since M-C&S is using 5 Joy Challengers on the rock, three Joy semi-radial, four-cylinder WN-224 water cooled, two stage compressors are used for air requirements. The WN-224 is the largest package-type compressor available.

Your projects may not be Niagara size but if you're drilling rock, ask a Joy Engineer about equipment that *profits you!*

Write Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa. In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 252-24.

W&W C7280-252

JOY Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.

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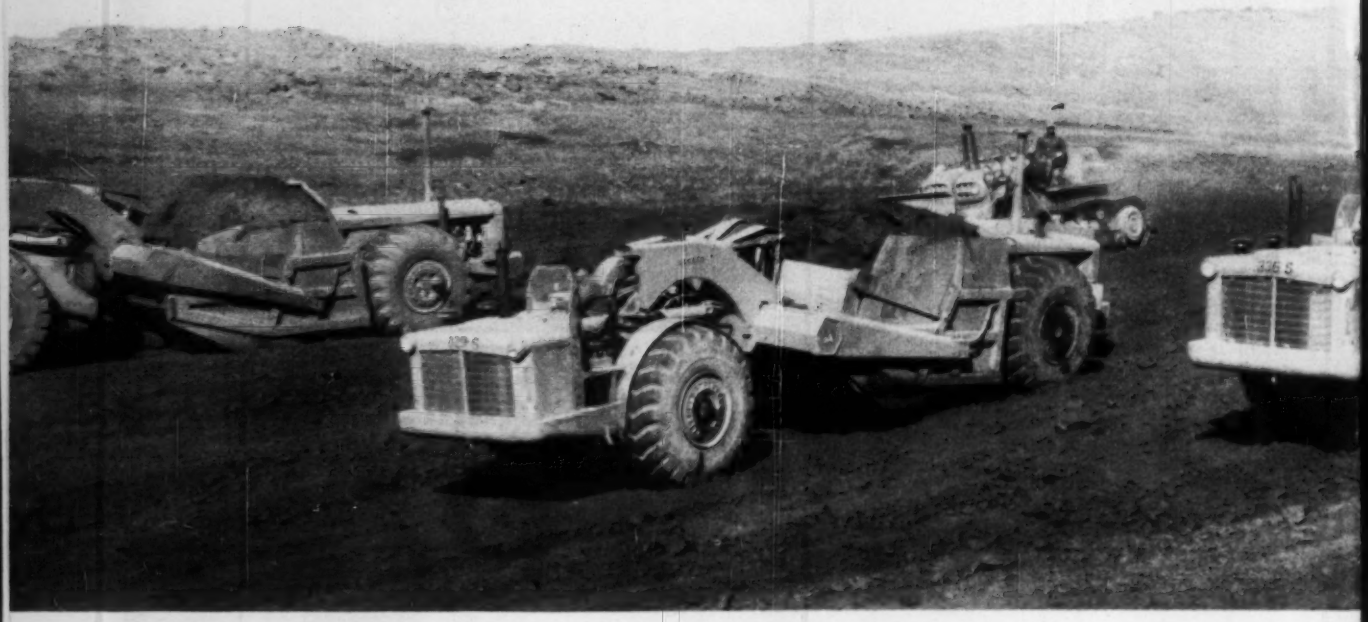
PORTABLE AND SEMI-PORTABLE AIR COMPRESSORS • ROCK DRILLS • TRAC-DRILLS • DRILL BITS • BACKFILL TAMPERS • SPADERS
PAVING BREAKERS • SHEETING DRIVERS • DRIFTERS • PORTABLE HOISTS • FANS AND BLOWERS • PORTABLE SAFETY LIGHTING

Western Contracting using



73 of them are Twin-Powered

Stage IV of Oahe Reservoir Project in South Dakota is a huge earthmoving job that involves 24½ million yards of excavation. Western Contracting Corp. is nearly a year ahead of schedule on their contract with the Corps of Engineers which calls for completion by November, 1959.

The Euclid fleet being used by this leading contractor totals 120 units . . . and 73 are big capacity, Twin-Powered scrapers, rear-dumps and crawler tractors. Working two 10-hour shifts 6 days a week, the "Eucs" are making the dirt fly . . . have moved as much as 110,000 yds. a day.

Twenty-five "Twin" Scrapers are push-loaded in heavy shale by big TC-12 Crawlers . . . get loads of about 30 yds. The TS-24 "Eucs" averaged 7½ loads per hour on a 2.2 mile cycle with several long grades up to 5½% adverse. Good supervision and excellent haul roads helped in maintaining this high production, but good loading ability and fast travel speed of the "Eucs" were important factors, too. Project Manager "Rip" Collins commented, ". . . if it weren't for the "Twin", the shale in the spillway section wouldn't be a scraper job".

On big projects like Oahe, and on small yardage work, too, "Twins" are moving the cheapest dirt. Your Euclid dealer can arrange a demonstration on your job and show you why "Twins" give you a greater return on investment . . . get in touch with him before you bid that next job!

EUCLID Division of General Motors, Cleveland 17, Ohio

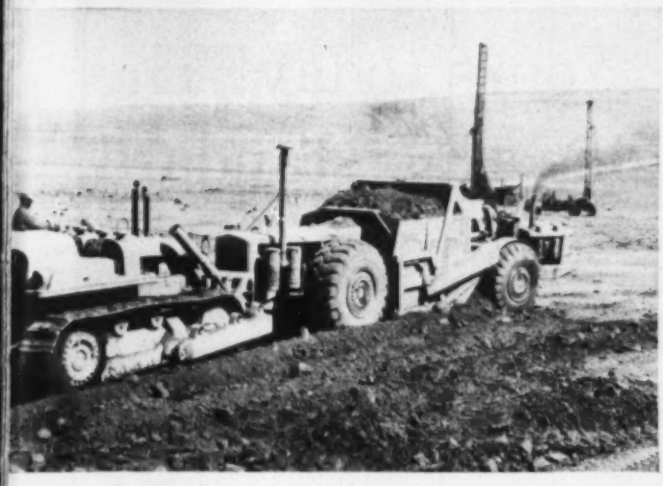
GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

120 "EUCS" at Oahe Dam...

For all big tractor jobs — push-loading large scrapers, heavy dozing, ripping hard shale and pulling big equipment — the TC-12 is a top performer. Independent track drive, full power shift with Torqmatic Drives and a total of 402 h.p. delivered to the power train give this Euclid "Twin" unequalled work-ability. Western has had TC-12 crawlers in their fleet for over 3 years . . . is using 18 of them at Oahe.



▲ *A total of 518 h.p., Torqmatic Drives, power on all four wheels, big capacity and a loading assist by Twin-Power "Euc" Crawlers, add up to high speed production. Here a TS-24 gets a heaped load of about 20 bank yds. of heavy shale in just over a half minute. "Twin" availability has been 90% or better in spite of working 20 hours a day, six days a week in tough material.*

Another application of Euclid "Twin-Power" is the 50-ton Model LLD. Western Contracting has used this size rear-dump for several years on big jobs such as the Indiana Turnpike, Ft. Randall, Gavins Point and Oahe Dams. With two 300 h.p. engines, each powering a separate axle through Torqmatic Drives, this "Euc" moves 50-ton loads over steep grades at fast travel speeds. ▶

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You've never worked with films like these before! Scalemaster films are Mylar* with a very high degree of *extra stabilization* added through an exclusive Ozalid process. These extremely durable, dimensionally stable films safeguard your investment in valuable originals. They're practically impossible to tear—won't fray, crack, "dog-ear," or become brittle, and can be filed indefinitely without deterioration. And fast! Scalemaster films are extremely transparent for the fastest copies possible . . . and with maximum contrast. Your draftsmen can draw and dimension precisely in one operation . . . with accuracy never before attainable. In fact, in many fields, Scalemaster films can often help eliminate entire reproduction steps.

But why not see for yourself? Send for sample sheets of Scalemaster films today and test the performance advantages they give you. Write: Ozalid, Dept. M-9-11, Johnson City, N. Y.

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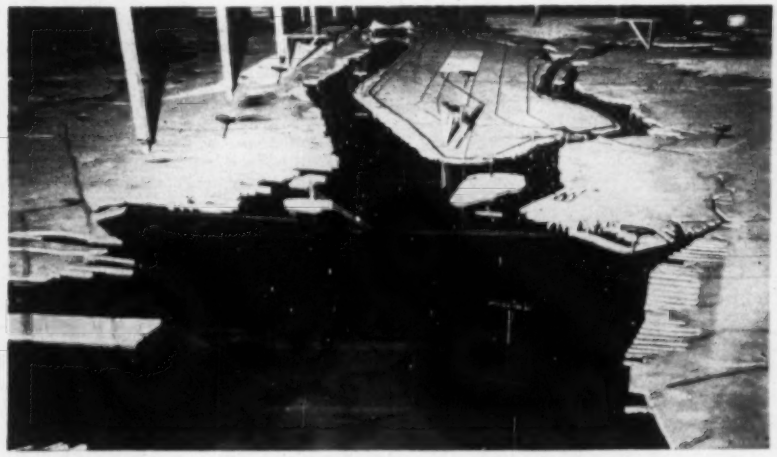
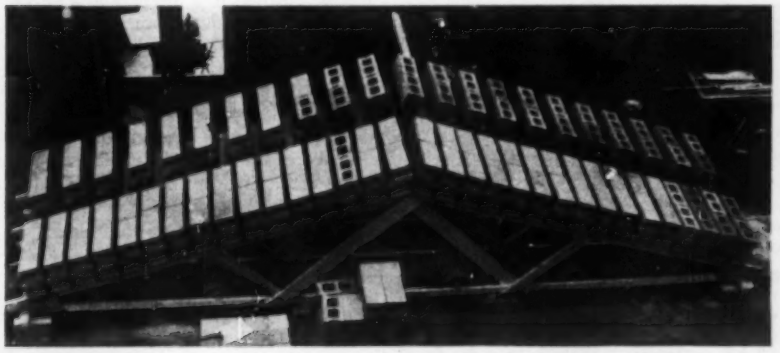


River Model Aids Siltation Study

The Corps of Engineers has constructed a hydraulic model of an 80 mile stretch of the Hudson River for a siltation study at the Waterways Experiment Station, Vicksburg, Miss.

The study is part of an investigation authorized by the House Committee on Public Works to determine how to reduce shoaling in pier slips in New York harbor.

The river is reproduced to scale from its mouth in Upper New York Bay to Poughkeepsie, N. Y. The model also represents New York harbor from Sandy Hook to Long Island Sound, including Raritan Bay, Arthur Kill, Kill Van Kull, Newark Bay, Jamaica Bay and the East River. Tidal portions of the Passaic and Hackensack Rivers and the Raritan River up to the Edison Bridge also are included. Vertical scale is 1 to 100 and the horizontal scale is 1 to 1,000.



Load Tests Lead to Better Roof Framing

There is a wide variation in the strength of different types of conventional house roofs. Maximum roof load-carrying capacities range from 18 to 125 psf, depending on joint details and rafter size.

These were among the findings of a 2½ year study and testing program recently completed by the Division of Building Research, National Research Council, Canada. More than 125 load tests were conducted to determine the strength and deflection characteristics of conventional roof framing systems and trussed rafter construction.

Several economical, lightweight, nailed wood-truss designs were developed as a result of the tests. The trusses were designed and tested for 4 on 12 and 5 on 12 roof slopes and spans of 24, 26 and 28 ft. They are intended for use at 2 ft spacing and

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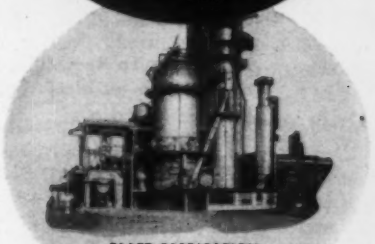

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This tough, rugged chain tape is justifiably called a "drag tape". It withstands the rigors of daily field use in all kinds of terrain. It outlasts most other tapes because . . .

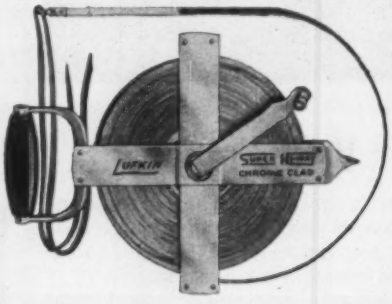
It Has Raised Markings and protective borders that are a part of the actual tape and will last as long as the tape itself.

The Line Is 5/16" Wide of special analysis steel that resists kinking and breaking.

It Is Chrome Clad®, an all-metal finish. The line is built up with a series of electroplatings, with a final hard satin-chrome finish that is resistant to abrasion, rust and corrosion.

It Is Easier To Read. The raised markings stand out sharply against the jet-black background; cannot be obliterated by mud and dirt.

The SUPER HI-WAY Drag Tape is furnished in 100, 200 and 300 foot lengths, either with or without reels. Two leather end thongs and a chainman's conversion rule are supplied with each tape. Choice of three styles of end markings.



THE LUFKIN RULE COMPANY
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have average failure loads of 117 to 165 psf. The designs assume 2 x 4 in. top and bottom chords, of either eastern spruce or douglas fir.

Tests also were conducted to investigate the effect of partitions located at various positions under the bottom chord. They showed the trusses under load exerted forces on partitions varying from 10% to 65% of the total load. Researchers concluded designers should not assume that partitions located beneath trusses are non-loadbearing.

The maximum load occurred when a partition was located at the third point of the span, beneath the junction of long and short diagonal members. The minimum load occurred when a partition was located at midspan.

The truss designs have been submitted to Central Mortgage and Housing Corp., Canada, for use in houses built under the National Housing Act. Copies of the designs are being distributed by the CMHC.

Plain-Concrete Research To Be Subject of Meeting

The University of Illinois in cooperation with the National Science Foundation, American Concrete Institute, American Society of Civil Engineers, and the Reinforced Concrete Research Council will hold a conference on fundamental research in plain concrete, September 10-12, Allerton Park, Ill.

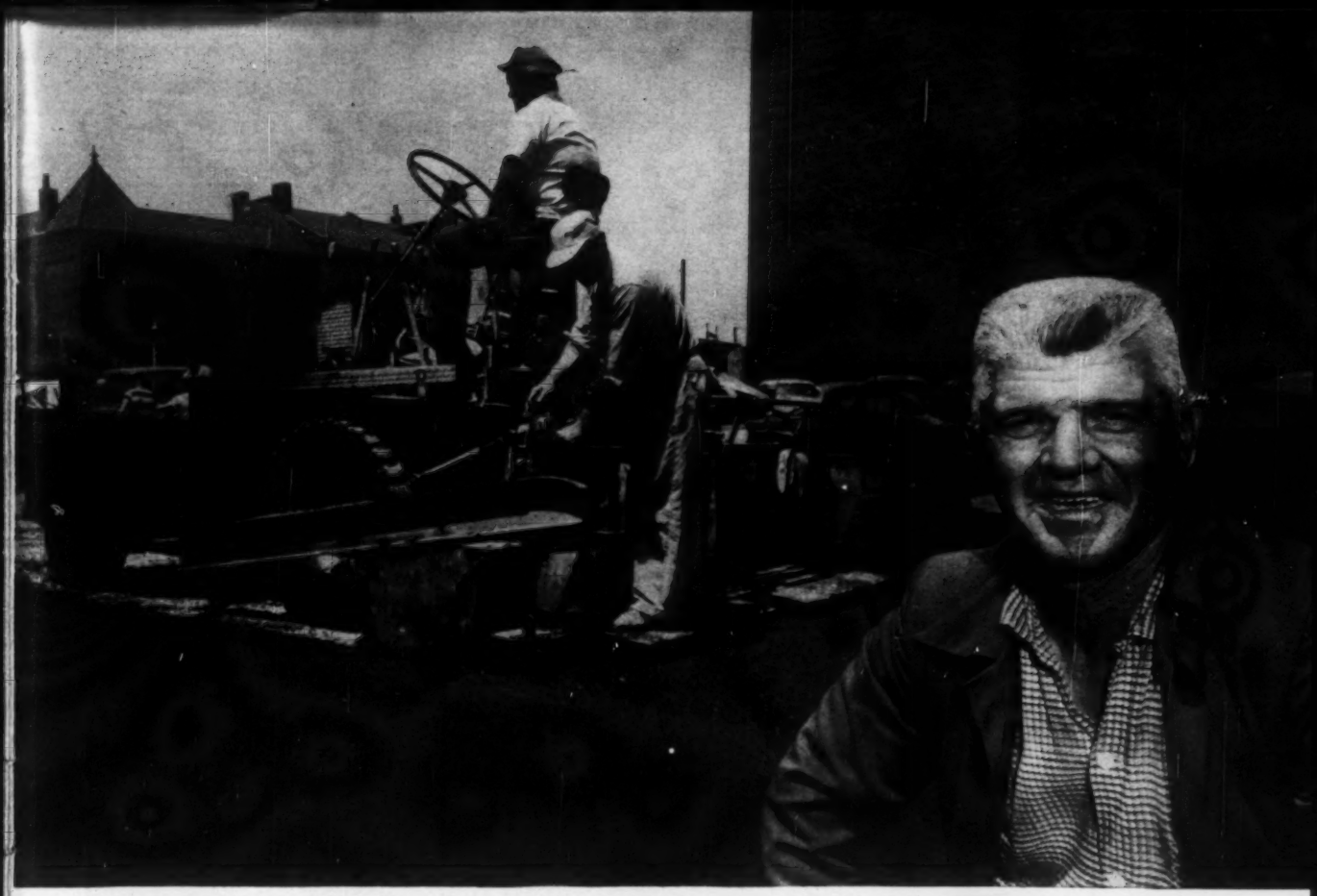
The major portion of the conference will be devoted to a discussion of future research and development of new thoughts and ideas. Chemists, psysicists, crystallographers, mathematicians, experts in the use of the electron microscope, and representatives of research organizations will be invited.

Anyone interested in attending may write Prof. Clyde F. Kesler, 103 Talbot Laboratory, University of Illinois, Urbana, Ill.

Acid Control in Deep Mines Given Up by Pennsylvania

Pennsylvania has abandoned its deep mine sealing program to prevent acid drainage into streams. Deputy Secretary Lewis E. Evans of the state Department of Mines and Mineral Industries said that millions of dollars have been spent on ineffective efforts to prevent stream pollution from deep mine drainage and that not one gallon of water was purified by the project.

The failure to control acid drainage from deep mines is in sharp contrast with the successful efforts made on strip mining control (ENR May 15, p. 29). Mr. Evans said mine sealing work is continuing at strip mine.



Peter E. Pellin describes the advantages of the Blaw-Knox Black Top Paver in his specialty—smaller paving jobs—while paving a parking lot. He works his Blaw-Knox unit from five to eight hours daily.

"The Blaw-Knox Black Top Paver is the only machine that met our specifications"

"Our selection of the Blaw-Knox Black Top Paver resulted from several factors. We needed a unit that was well engineered, highly maneuverable, yet relatively inexpensive. The Blaw-Knox PF-45 filled the bill. Its performance and maintenance have been excellent," says Peter E. Pellin, owner of Pellin Paving Company, St. Louis.

"We use it for a wide variety of jobs including parking lots, filling stations, playgrounds and resurfacing. These jobs range from 1,000 to 33,000 square yard class," Mr. Pellin explained. "Our operators were trained in a day. Visibility range is excellent, permitting the operator to work with a minimum of extra help," he adds.

Like many other contractors, Mr. Pellin relies on the exclusive features and engineering quality of the Blaw-Knox Black Top Paver to help him do a wider variety of work more efficiently. Your Blaw-Knox distributor can show you how to put this profit-building equipment to work. See him soon.

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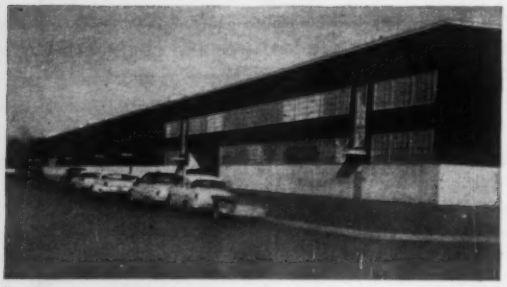
. . . we've come to depend on International Steel."



The doors for this maintenance hangar . . . plus the structural steel for the supply warehouse (illustrated at left) are from International Steel.

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Channels Make H-Pile Sleeve

A pair of channels make up a new type sleeve for splicing additional sections to H-beam piles being driven. Advantages cited for the simple connection are savings in time and money resulting from a shorter weld plus quick and easy alignment of the pile sections.

Two lengths of channel are put back-to-back with a space between them the thickness of the H-beam web. The sections are held to each other by a rectangular steel spacer that later acts as a key into the beam web.

The sleeve is used as follows. The H-beam extension to be driven is laid on its side at a height convenient for a welder. A small slot is cut into the end of the beam web to take the sleeve key. The sleeve is slipped onto the beam and forced home with a sledge hammer until the key has gone into the slot in the beam web.

The result is that the backs of the channels are in tight contact with each side of the web of the beam, and the channel legs are hard against the insides of the beam flanges. A short section of each channel leg then is welded to the inner surfaces of the beam flanges. The pile is then turned over and the weld repeated on the opposite side.

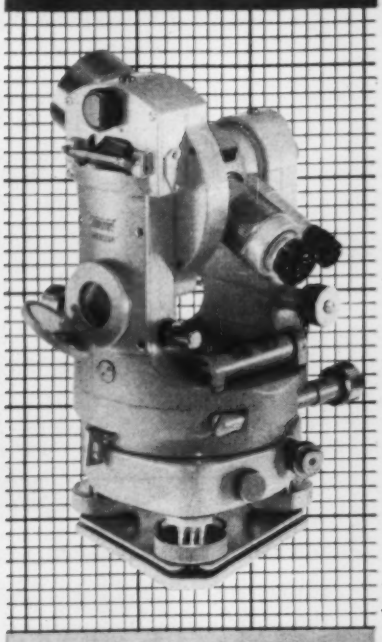
The extension with the splice sleeve attached then is positioned on the previously driven pile section. Since the sleeve is a driving fit, alignment of the upper and lower H's is practically automatic. After the top steel is firmly seated, 3 in. of the lower channel legs are welded to the bottom pile section. Final step is the butt welding of the exposed H-beam flanges. The spliced pile is then ready for driving.

Whereas 166 in. of bead is needed for a conventional double pass butt weld on a 14 in. BP section, only 86 in. of weld is necessary when the new sleeve is used.

Furthermore, in the splicing of vertical piles, the sleeve alone will adequately support the upper section during the welding operation. This releases equipment for other work. For batter piles, however, it is recommended that the extension be supported by a rig throughout the welding operation.

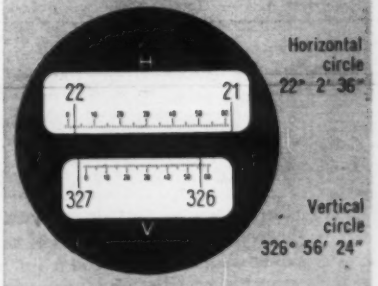
First job application of the new sleeve is being made by the Underpinning & Foundation Co., Inc., New York City, on an overpass structure. Inventor of the patented sleeve is F. L. Pruyn, who is associated with the firm. The sleeve has gone through laboratory tests and proved out stronger than the

Fennel
UNIVERSAL THEODOLITE FT I



Both circles can be read simultaneously

Readings direct to one minute



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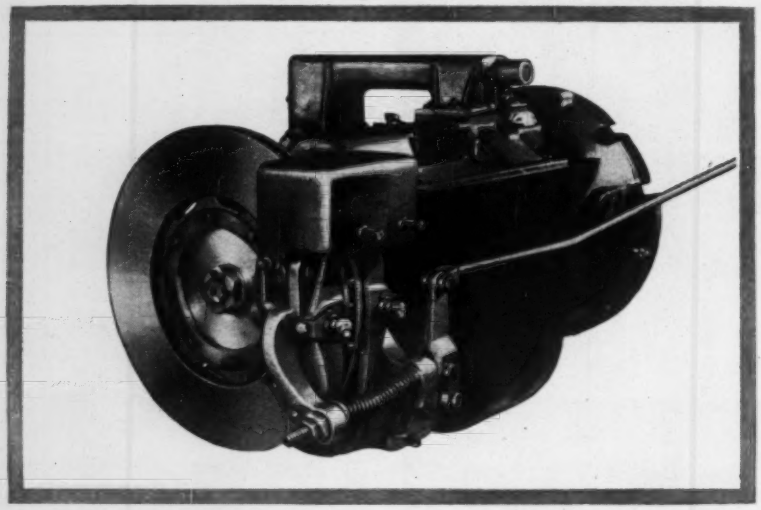
You Get Positive Protection Against Runaway or Parking Accidents When You Specify TRU-STOP Brakes

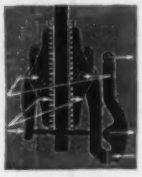


TRU-STOP brakes operate directly on the drive shaft. This means that they are not only excellent parking brakes, but dependable emergency service brakes as well. There's no dangerous self-energizing. TRU-STOP brakes have the surplus capacity for repeated use as an auxiliary to service brakes.

100% Ventilation Minimizes Fading

Brake efficiency depends on ability to dissipate heat rapidly and so prevent fading. TRU-STOP brakes are 100% ventilated. Discs are exposed to air even while braking. The TRU-STOP ventilation system circulates air *between* the disc plates.

Longer Life with Uniform Brake Pressure



The discs of TRU-STOP brakes are squeezed between the flat surfaces of the shoes. The brake lever operates both the front and rear lever arms simultaneously, and pressure is exerted on the center of each shoe. This puts the entire lining surface in contact, provides for even wear. TRU-STOP brake linings are *easy* to replace.

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H-beams themselves. As a result, the Department of Public Works of the City of New York has approved them for use in pile foundations.

Sleeves fit all standard BP sections. COMMERCIAL SHEARING & STAMPING CO., YOUNGSTOWN, OHIO.

New Model Tractor-Shovel Features 7,000 lb Capacity

Already in production and replacing a smaller model is a new four-wheel drive, rubber-tired tractor-shovel with a carrying capacity of 7,000 lb.

The new unit, Model H-70, is powered by 110 hp gasoline or diesel engine and provides more traction, greater protection against dirt and dust, and more efficient torque converter than its predecessor, according to the manufacturer. The new unit also features complete power-shift transmission, power-transfer differentials, power-steering, pry-out bucket action, safety boom arms and power-boosted brakes.

An additional 1,500 lb of weight is carried on the rear wheels due to improved weight distribution, thus providing better traction and greater digging effort.

A triple air cleaner system with pre-cleaner and two-oil-bath cleaners are provided to give the fullest protection of the engine when operating in dusty conditions, while a cartridge-type oil filter is built into the hydraulic reservoir. Similar filters protect the engine oil, the transmission and troque-converter oil. The front service brakes are sealed to keep out dust, dirt and foreign matter.

The tractor-shovel has three speeds in each direction by means of a specially designed power-shift transmission. The torque-converter is a single-stage, two-phase converter with a torque-multiplication factor of 2.72 to 1 at stall. THE FRANK G. HOUGH CO., 772 SEVENTH AVE., LIBERTYVILLE, ILL.

Drift Hazard Can Be Cut With Weed-Killer Chemical

A weed and brush control that promises to be effective while cutting the sprayed drift hazard to a minimum has been developed. It is called Inverton 245.

This weed killer is an invert emulsion and, consequently, has a thick, creamy consistency that keeps it from breaking into a mist when sprayed, and permits its use even in wet weather.

Standard spray equipment may be used to apply the new chemical. Dow CHEMICAL CO., PRODUCT INFORMATION SERVICE, MIDLAND, MICH.

(*New Products continued on page 120*)

Man and boy at right dramatize size of this 80′ x 360′ Stran-Steel building owned by West Jersey Warehouses, Inc., of Bridgeton, N.J. Here is 28,800 square feet of working space.

MASS-PRODUCED FOR SAVINGS... CUSTOM-FITTED TO YOUR NEEDS!

In your next building—factory, warehouse, or retail outlet—get these three big benefits: 100% useable clear-span interior, firesafe all-steel construction and a 5-year payment plan. They're all yours with a Stran-Steel Rigid Frame building!

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The Stran-Steel method of construction means you get top design flexibility. Mass-produced components give you major economies and, at the same time, permit you to tailor your building to the size, function and appearance you specify. Insulates easily, takes cranes or monorails, combines effectively with other materials —like brick, masonry, wood and glass. And Stran-Steel's precision pre-engineering means your site-assembled building goes up in days, stays up for decades with minimum upkeep and operating expense.

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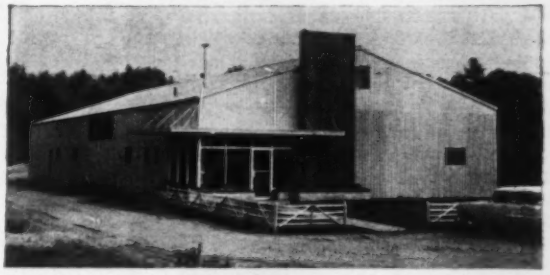
Without affecting your regular credit lines, you can buy this versatile, durable building through the Stran-Steel Purchase Plan. Pay as little as one-fourth down for the completed structure—including foundation, erection cost and tax—with as long as five years for the balance. Your building works for you as you pay. Mail the coupon now for more information or call your Stran-Steel dealer. He's listed in the Yellow Pages under *Steel Buildings* or *Buildings—Steel.*



Good-looking, hard-working manufacturing plant for Standard Fence Co., Manchester, N.H. Stran-Steel factories can be expanded easily when you need more production space.

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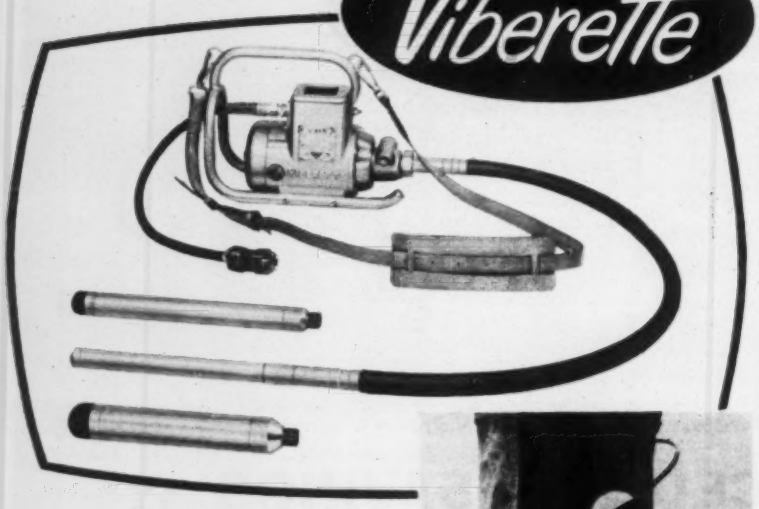


in prestress work
in narrow forms

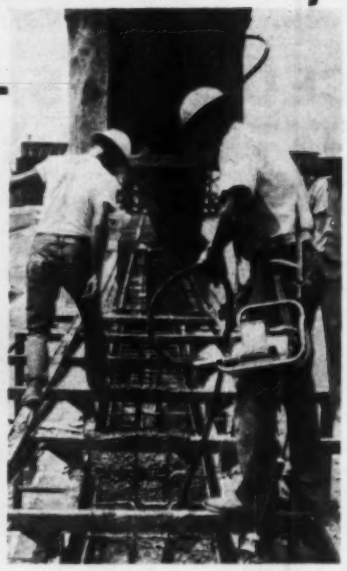
Hard-to-reach places and narrow stems of prestress T-sections are no longer a problem when the new Viberette Vibrator is on the job. It is designed especially for prestress and narrow form building construction.

The *12,000 rpm speed* and low amplitude of Viberette produces extremely effective vibration in consolidating low slump concrete.

A *small diameter* flexible drive with replaceable rubber tipped head makes it ideal for concrete compaction in constricted areas.

A *powerful,* universal ¾ HP electric motor gives Viberette plenty of "kick" for thorough vibration.

The 19 lb. Viberette Vibrator with new, dual grip, skid type handle makes the entire unit easy for one man to operate. A new shoulder strap attachment leaves both hands of operator free to manipulate the flexible drive.



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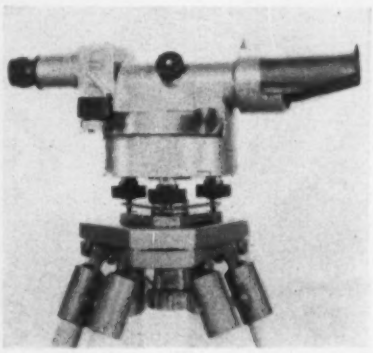

German Self-Leveling Level Now Available in U. S.

A self-leveling level has been introduced by Precision Instruments Inc., of Troy, N. Y., for engineers and surveyors. Known as the INA automatic level, the instrument is made in West Germany by Ertel-Werk—European surveying instrument manufacturers.

The line of sight automatically assumes a truly horizontal position once the instrument has been approximately leveled by its circular bubble. The self-leveling system consists of a pair of carefully positioned prisms that move automatically with any change of instrument setting to give precise realignment of the line of sight.

Use of this instrument can reduce actual working time as much as 50% in extensive leveling operations, the manufacturer reports. Sources of errors, such as creep of the spirit level bubble, are eliminated and accidental changes in position are automatically compensated.

The level is a compact 5⅛ in. high. Its 30X telescope is 7½ in. long and with its tripod weighs 19¼ lb. The lenses are coated and the reticle is of glass with stadia lines 1:100. The level is equipped with fixed length or European type extension tripod, and is packed in a wooden or metal case with accessories. BULLETIN PI-INA, PRECISION INSTRUMENTS INC., 1900 FIFTH AVE., TROY, N. Y.

Liquid Chemical Additive Speeds Concrete Setting

Sika-Set, a new liquid chemical additive for concrete and mortar mixes, has been introduced.

According to the manufacturer, Sika-Set increases durability and water resistance of concrete and mortar. It is said to accelerate the hardening action and to permit early formstripping. SIKA CHEMICAL CORP., BUILDING PRODUCTS SALES DIV., 35 GREGORY AVE., PASSAIC, N. J.

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Whether it's curing a slab on grade, a multi-story job or a highway, there's a Sisalkraft paper available to give you *better concrete at low cost.* Proven Orange Label Sisalkraft is the standard for curing — in addition to its re-use advantages. There's also a variety of grades manufactured for special curing requirements. Stock widths are from 36″ to 96″. Custom widths to 26½′.

Write our main office at Attleboro, Mass. for the booklet "Curing and Protection for Better Concrete."

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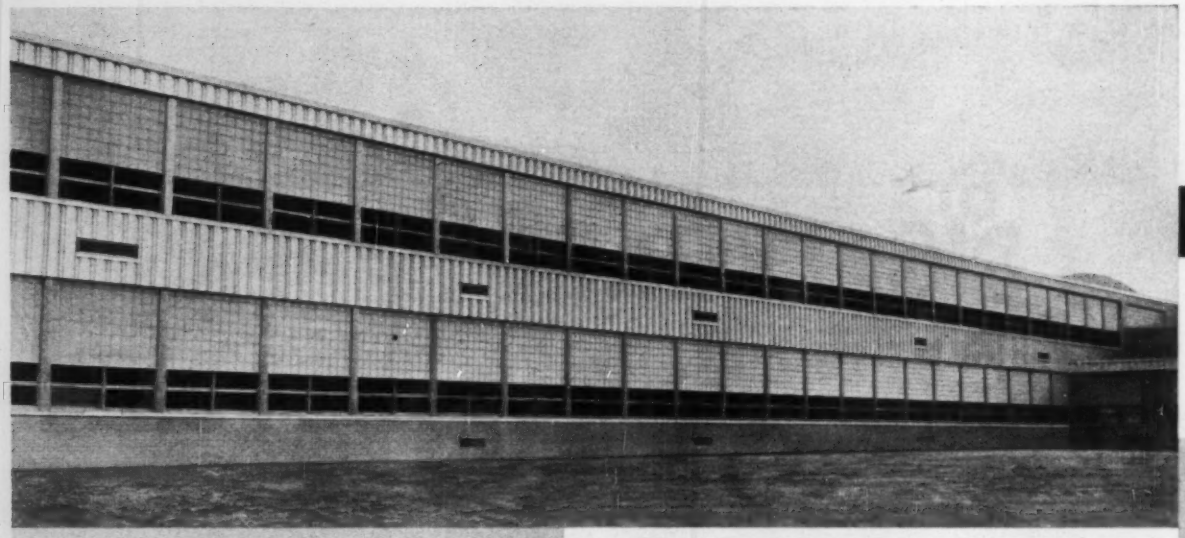
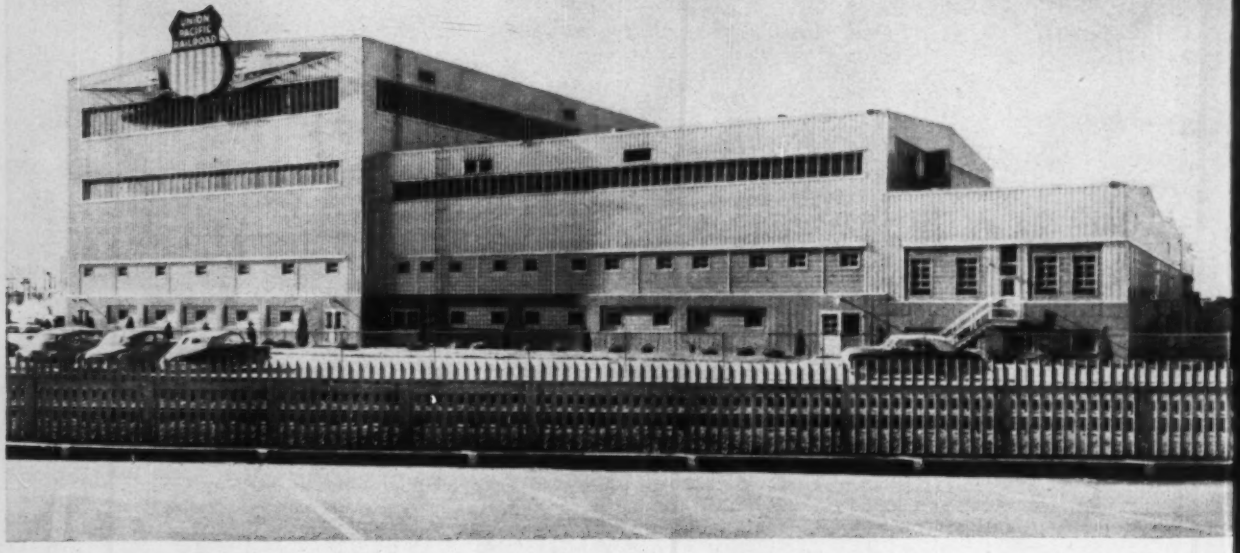
Mahon METAL CURTAIN WALLS



Above: Mahon Stainless Steel Curtain Walls employed in the construction of the EDISON JUNIOR HIGH SCHOOL, West Mifflin Boro, Pennsylvania. Lamont H. Button and Paul F. McLean, Architects. Nicholas La Donne, General Contractor. Below: UNION PACIFIC RAILROAD'S NEW DIESEL LOCOMOTIVE REPAIR SHOP at Salt Lake City, Utah. Walls of this modern building were constructed with Mahon Prefabricated Aluminum Wall Panels.



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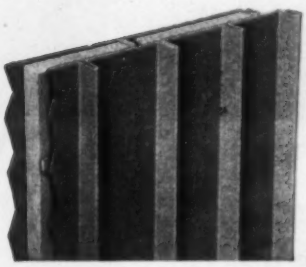
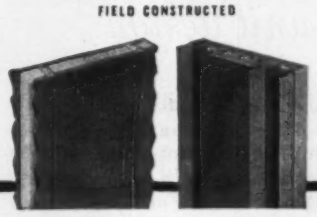


MAHON RIBBED WALL
FIELD CONSTRUCTED



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—with cost-saving twin-unit design

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The new Le Roi rotary is a portable cyclone — delivers a full 1200 cfm of air at 100 psi — plenty of power for the *big* demands of pile driving, large-hole quarry drilling, tunnel jobs, multiple pipe line rigs, shaft jumbos, or as a stand-by source of plant air. One 1200 replaces a dozen small portables — eliminates site clutter and the need for extra men and trucks for hauling—minimizes between-job delays and slashes fuel consumption and maintenance.

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Publications

Vermiculite data sheets—Roof insulation Sheets No. 1 and 2 cover 1:6 and 1:8 mixes for use over vented galvanized steel decks. Sheets No. 3 and 4 cover the same mixes for use over structural or precast concrete decks. Vermiculite Institute, 208 S. LaSalle St., Chicago 4, Ill.

Water repellent—NACOR invisible silicone-base water repellent for above grade masonry structures. Bulletin W-302. National Asphalt Corp., Bulkley Building, Cleveland 15, Ohio.

Steel joists—Layouts of underfloor electrification using Electro-Channel steel joists. 25 page manual. Ceco Steel Products Corp., 5601 W. 26th St., Chicago 50, Ill.

Drives and couplings—Description of a dry fluid drive called "Flexidyne" that uses heat treated steel shot instead of fluid to act as flow charge for drive. Specifications indicate advantages offered in starting loads smoothly, protecting against overloads and reducing maintenance through saving wear on motors and controls. 24 page Bulletin A640B. Dodge Manufacturing Corp., Mishawaka, Ind.

Chicago architectural workshop—Six Chicago architects report on thin-curtain-wall buildings. Contains photographs and drawings of buildings discussed. 62 pages. U. S. Steel Corp., 525 William Penn Place, Pittsburgh 30, Pa.

4-D wrought iron—Illustrates in-service and laboratory tests conducted with 4-D wrought iron. Discusses corrosion resistance in condensate lines, high temperature services, hot-water lines, heat exchangers, tanks and gas lines. 8 page booklet. A. M. Byers Co., P. O. Box 1076, Pittsburgh 30, Pa.

Aluminum windows—Commercial and monumental double-hung series, projected series, and heavy awning styles. 24 page Bulletin 6013-E. Ceco Steel Products Corp., 5601 W. 26th St., Chicago 50, Ill.

Kaisaloy — Characteristics of high-strength, low alloy steel. 20 page booklet. Kaiser Steel Corp., 1924 Broadway, Oakland 12, Calif.

Bearing pads—Bridge and structural bearing pads made of Voss Neosorb molded neoprene and Voss Sorbtex impregnated fabric pad materials for

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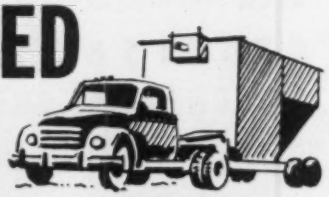

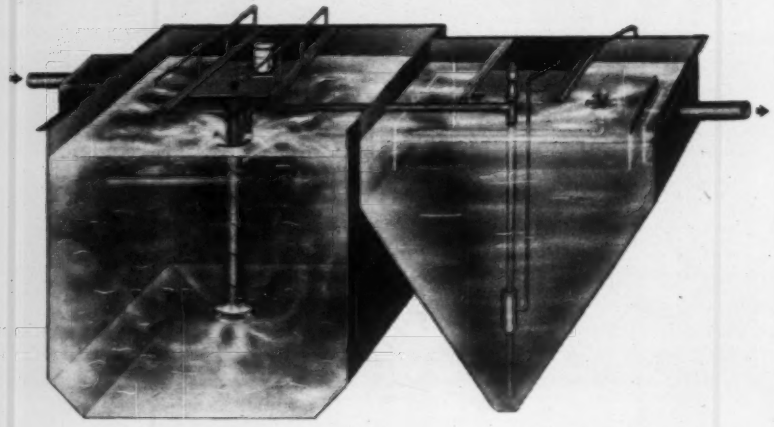

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bridges, structures, railways, expansion joints, guard rails, lamp base mounts and water main mountings. Preformed Pad Division, Voss Belting and Specialty Co., 5645 N. Ravenswood Ave., Chicago 26, Ill.

House frame design—Based on Teco trussed rafter system of roof framing using Wedge-fit ring connectors. The 1½ story frame is expandable. Plan No. 620. Timber Engineering Co., 1319 18th St., N. W., Washington 6, D.C.

Lathing information—Specifications for solid and hollow partitions, wall furring, metal lath attached to wood supports, and other subjects. Metal Lath Manufacturers' Association, Engineers Building, Cleveland 14, Ohio.

ACI concrete primer—Expanded to 72 pages, the revised ACI primer is still pocket size. Covers principles of concrete mixes, and application to structural design. American Concrete Institute, PO Box 4754, Redford Station, Detroit 19, Mich.

Prestressed concrete design—Volume 9 in a series of prestressed concrete design handbooks prepared by Leap Concrete, Inc., covers 5 ft wide by 18 in. deep double-tee roof members. Data include safe superimposed loads for spans of 20 to 61 ft for members prestressed with ⅞ in. dia strand, straight and curved. A data sheet for each strand pattern gives spans, loadings, prestressing forces, principal concrete fiber stresses, camber and deflection. Copies may be obtained for $2 from Leap Concrete, Inc., P. O. Box 1053, Lakeland, Fla.

Rotary drills—Description of gas, oil and water well drilling rigs. Rated capacity over 3,500 ft. with 2⅞ in. pipe and 2,500 ft with 3½ in. pipe. Model M-7WA features a hydraulically-operated mast to handle 20 ft lengths of drill pipe. Catalog E-270. Davey Compressor Co., Canton, Ohio.

Electric heating elements—Data sheet describing details and specifications of flat, sinuated heating elements. Syntron Co., Homer City, Pa.

Stadium concreting—Review of case histories of concreting problems involved in stadium and auditorium construction. 20 page pamphlet. The Master Builders Co., 7016 Euclid Ave., Cleveland 3, Ohio.

Latex paint—Composition, history and uses of latex paints. The Dow Chemical Co., Midland, Ohio.

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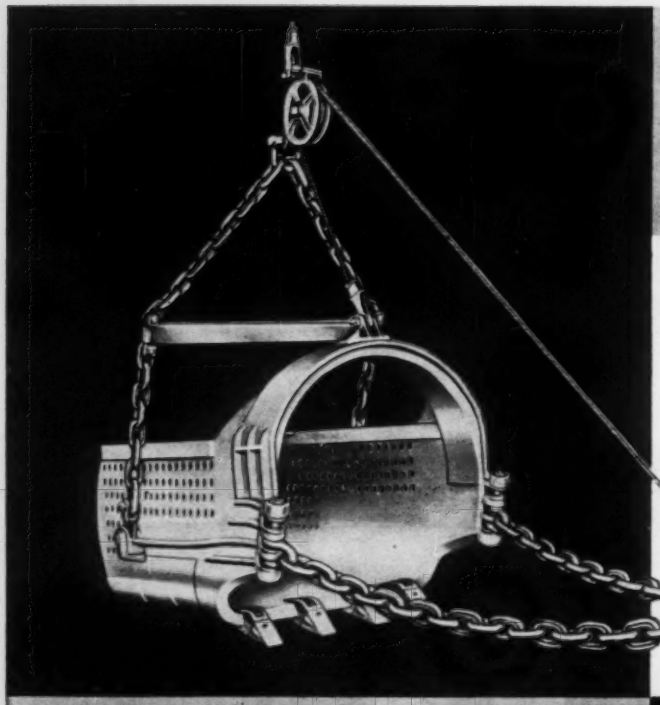

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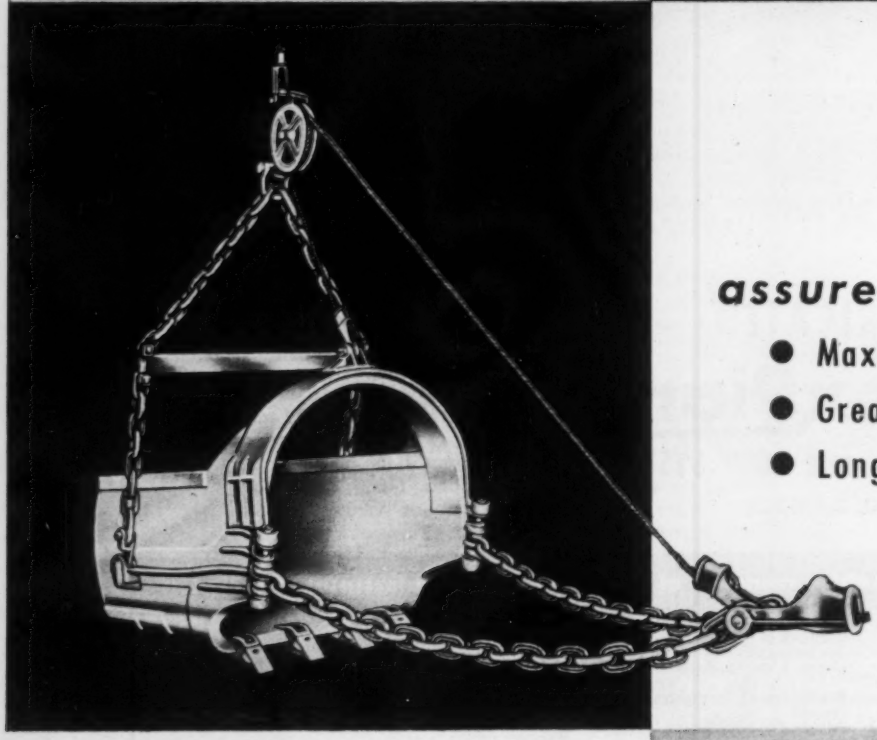

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LeRoy A. Brothers Will Be Drexel's Engineering Dean

LeRoy A. Brothers has been appointed dean of the College of Engineering of Drexel Institute of Technology. He succeeds Harry L. Bowman, who continues as dean of the faculty.

For the last 12 years, Mr. Brothers was with Headquarters, U. S. Air Force, in Washington, D. C., as assistant for operations in the office of the Deputy Chief of Staff Operations.

A civil engineering graduate of North Carolina State College, Mr. Brothers was associate professor of civil engineering at Drexel from 1927 to 1945. During World War II he was on leave of absence from Drexel. He served on the National Defense Research Committee, and later as a principal intelligence analyst with a British-American research unit in England, analyzing targets and weapons of the Eighth Air Force.

In 1944 Mr. Brothers joined Operations Analysis, U. S. Air Force. He served as analyst and chief of the Operations Analysis Section, India-Burma sector, China-Burma-India theater; analyst at the 20th Air Force Section in Washington, D. C.; and Chief of Section, 21st Bomber Command, in Guam. The following year, he was with the U. S. Strategic Bombing Survey as chief of the Analysis Branch, Physical Damage Division.

University Vice President Named Utah Road Director

Elmo Morgan, 45, business vice president of the University of Utah, has been named director of the Utah State Road Commission.

He succeeds Ellis L. Armstrong who, October 1, becomes the Commissioner of Public Roads in Washington, D. C. (ENR Aug. 28, p. 59).

In making the announcement, Road Commission Chairman C. Taylor Burton said that Mr. Morgan had been appointed because of his knowledge in engineering and business administration and his close association with Mr. Armstrong while he worked for the commission.

Careers

Business

B. K. Hough has resigned as professor of civil engineering at Cornell University to devote full time to his practice in soils engineering in Ithaca, N. Y.

Gordon Massey has retired as suburban development engineer for the Pennsylvania Railroad. He is succeeded by **David McCue,** who was assistant suburban development engineer.

Parker C. Folse, Jr., has been named director of design for Fox & Jacobs Construction Co., Dallas homebuilders.

James D. Ghesquiere has become vice president in charge of engineering for The Hinchman Corp., Detroit specialists in corrosion control. He was formerly chief engineer for the firm.

Tom McGovern has been elected vice president in charge of heating, and **Frank Weber,** vice president in charge of plumbing, for Piping Contractors Co., Columbus, Ohio, industrial piping and mechanical contractor.

Joseph J. Hulfeld, with the firm for 20 years, has been elected president of A. M. Strauss and Associates, Inc., Fort Wayne, Ind., architectural-engineering company. He succeeds the late A. M. Strauss, founder and president. Also elected were: **Herman S. Strauss,** vice president; **Ralph E. Coblentz,** secretary; and **Edward A. Gibson,** treasurer.

Martin E. Roberts has been elected vice president and director of Lummus Company Canada, Ltd., engineers and constructors, Montreal. He formerly was manager of that office.

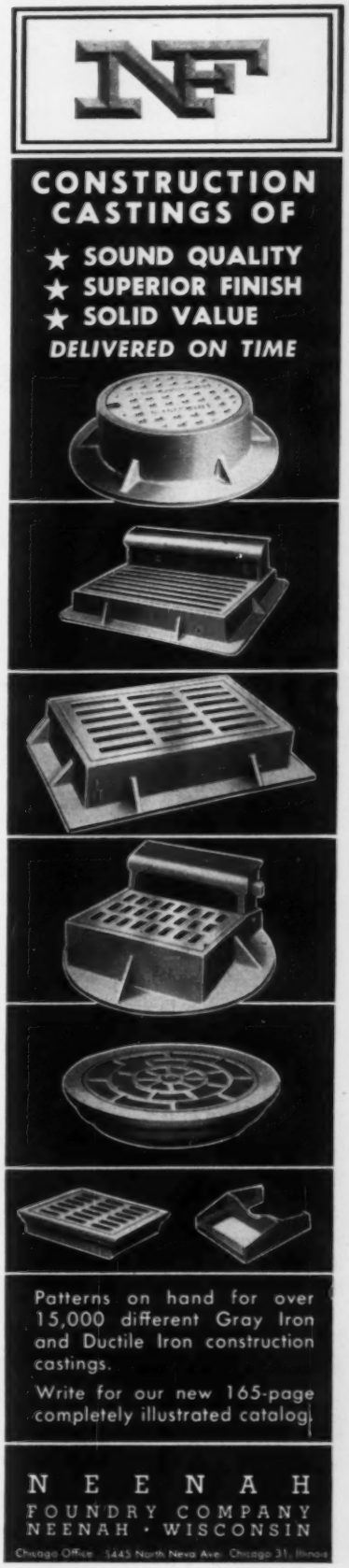
Charles Gilman, associated for many years with Massey Concrete Products Co., is now a concrete products consultant with offices in Plainfield and Newark, N. J. He will specialize in precast concrete building products.

James B. Taylor, Jr., has been elected a vice president of George A. Fuller Co., and assigned to the New York City office. He joined the company in 1940. His more recent projects include the new Travelers Insurance Co. Building and the new addition to the Aetna Life Insurance Co. Building, both in Hartford, Conn.

Paul Nelson, architect and hospital planner, is now associated with the New York City architectural firm of Ketchum & Sharp. He will specialize in research, planning and design of all types of medical buildings.

The Foundation Co. of New York City has opened a new office in Pittsburgh with **Carl A. Ilgenfritz** in charge. Mr. Ilgenfritz recently retired as vice president in charge of purchasing for U. S. Steel Corp.

P. N. Veale has been appointed manager to the Montreal office of Simon Engineering Companies of Canada, Ltd., materials handling engineers. He succeeds **W. J. Hopkins,** who will take up a new appointment with the parent company, Simon Handling Engineers, Ltd., of Cheadle Heath,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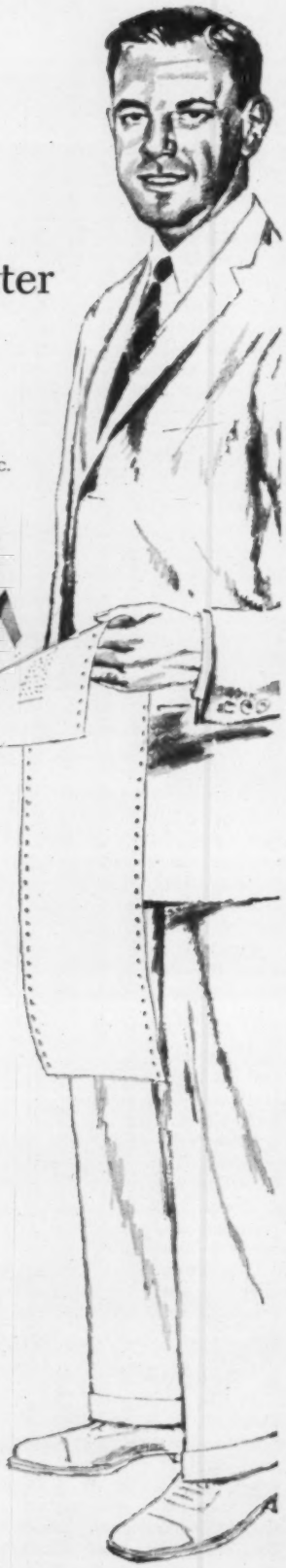

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. . . Men and Jobs

England. **M. E. Hornback,** former chief mechanical engineer to Aluminium Company of Canada, Ltd., has been appointed director and consultant to the Simon firm in Canada.

W. R. Wilkinson, a senior vice president of Johns-Manville Corp., has become general manager of the company's building products division. He began his career with the company in 1915 and chiefly has been concerned with sales, production and sales promotion.

Patchen, Mingledorff and Williams is the name of a new consulting firm formed in Augusta, Ga. The principals are all former members of the firm of Patchen and Zimmerman, which has been dissolved.

Associations

The New York Chapter of the American Institute of Architects has elected **L. Bancel LaFarge** president. He is a partner in LaFarge, Knox & Murphy, New York City.

Frank P. Hyer is new president of the Delaware Society of Professional Engineers.

Lachlan F. Blair, Providence, R. I., planning consultant, has been elected president of the New England chapter of the American Institute of Planners. He was formerly chief of the planning division of the Rhode Island Development Council.

Richard E. Chislett has been appointed secretary-treasurer of the National Constructors Association, succeeding **C. B. Bronson.** Mr. Chislett formerly served as chief of the Employer Relations Section, International Labour Office, Geneva, Switzerland.

Public Works

Max Suter has retired as principal engineer of the Illinois State Water Survey. Noted for his studies in artificial recharge of groundwater, he has been associated with the survey since 1936. Through his research, new theories have been developed in replenishing groundwater.

Lewis E. Knerr, head of the design branch of the engineering division of the Portland, Ore., District, U. S. Army Engineers, has retired after 29 years of service with the Corps.

John Leighton has joined British Columbia Power Commission as head of its new program control division. He was construction manager of Ontario Hydro Electric Power Commission's Whitedog-Cariboo project.

Bill L. Andrews has been made assistant regional engineer of the Fort Worth region of the U. S. Bureau of Public Roads. He had been, and will continue to be, regional design engineer.

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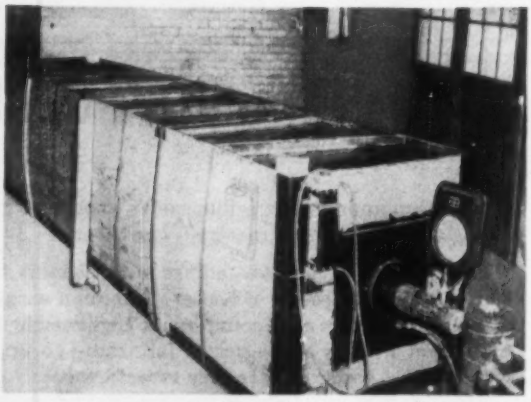

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Obituaries

Col. Earl E. Gesler, Sr., a beach erosion authority, in Washington, D. C. He was president of the Army Corps of Engineers Beach Erosion Board until his retirement from the Army in 1952. Since then, Colonel Gesler had served as a director of the American Shore and Beach Preservation Association. With the Corps he had been district engineer in Philadelphia and New York. He was a West Point Academy graduate, class of 1915.

George D. Youngclaus, 37, vice president of Western Concrete Structures Co., Inc., Los Angeles firm specializing in prestressed lift-slab construction. He was structural engineer with Portland Cement Association in Los Angeles from 1949 to 1956. A graduate of the University of Colorado and a World War II Air Corps officer, he was shot down over Rumania in 1944 and was a prisoner of war.

Andrew J. Meehan, 62, assistant planning engineer for the California Division of Highways' bridge department, with state service since 1921. A registered structural engineer, he was one of the engineers that designed the San Francisco-Oakland Bay Bridge.

Charles A. D. Young, 81, retired Bureau of Reclamation engineer, in Denver. An 1899 graduate of Purdue University, he worked on the design of Madden Dam in the Panama Canal Zone, TVA's Morris and Wheeler Dams, and Hoover, Shasta and Grand Coulee Dams.

John J. Carroll, 33, of Riverdale, N. Y., in Green Bank, W. Va., where he was associate project engineer for National Radio Astronomy Observatory. He was an architectural-engineering graduate of Catholic University of America and was attending George Washington University.

William H. Holmes, 63, veteran irrigation engineer and dam designer, in Weed, Calif. He had been employed by the California Water Resources Department for 24 years before he entered private practice in 1952. He headed California's dam division for 10 years.

Carl G. Lowe, 75, a Tulsa, Okla., engineer who played prominent roles in developing water, railroad and housing projects in that area.

Herbert W. Blakely, retired builder whose firm erected apartment houses in Toronto, Ont.

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- Modern, Centralized Lubrication

There are dozens of other important features that give you a long-life, big output machine. In the rugged lower works you'll find a mighty, one-piece carbody; long, wide-span crawlers with fully enclosed pads; fast, easy crawler tread adjustment; a heavy duty tread guide patterned after big machine design for perfect tread alignment; and a flat design roller path to provide precise load distribution.

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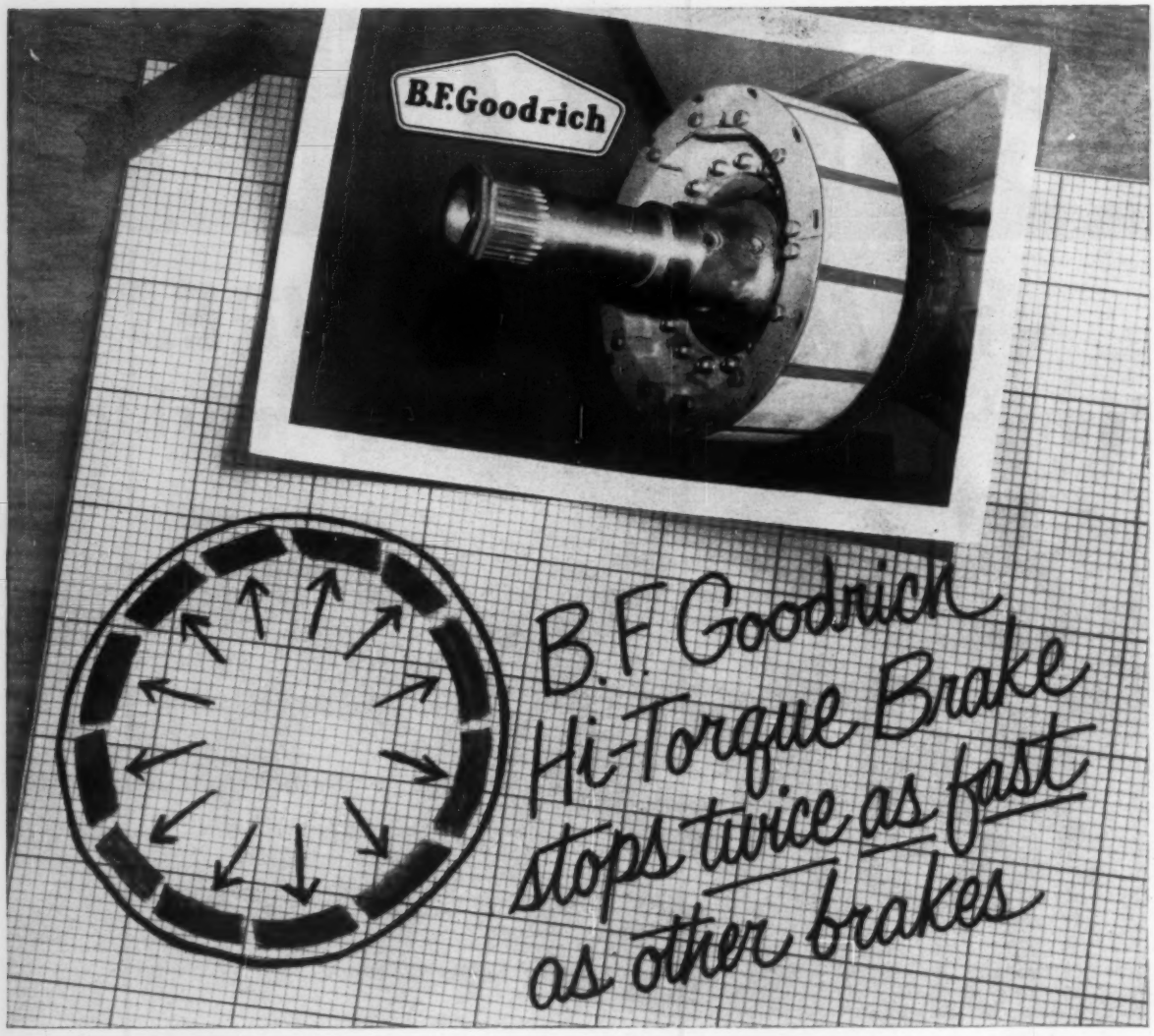

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Books

British Hydro Power

HYDRO-ELECTRIC ENGINEERING Edited by J. Guthrie Brown. Volume 1: Civil Engineering, 1,189 pp. ($27); Volume 2: Mechanical and Electrical Engineering, 740 pp. ($18); Volume 3: Economics, Operation and Maintenance, 473 pp. ($12). Published by Blackie & Son Limited, 17 Stanhope St., Glasgow, Scotland.

Monumental is the best way to characterize this British work on hydroelectric power development. Its three volumes total over 2,400 pages and its editors and contributors, numbering 24, are all well known specialists in the areas in which they write.

Chief interest for readers of ENR centers in Volume 1, Civil Engineering, but they also will find information of value in Volume 3 in the discussion of such subjects as multipurpose projects, pumped storage and the planning, design and construction of civil engineering works.

The scope of the civil engineering volume is impressive. It begins with a 46 page discussion of rainfall and runoff, which is followed by chapters on flow measurement, hydraulics and hydraulic models. These are followed by a discussion of basic principles of water power development, the over-all design of hydroelectric projects, and site investigations.

These chapters are followed by large chapters on gravity dams, embankment dams, arch dams and buttress and cellular dams. Spillway and flood-control works are discussed in detail, as are intake and outlet works and their equipment, canals and free-flowing channels, concrete and steel pipes and pressure aqueducts, surge chambers and water harness.

Seventy-four pages are devoted to a discussion of current British practice in design and construction of tunnels to serve hydro stations.

The latter part of the book is given over chiefly to the design and construction of power stations, including underground stations. The concluding chapter relates to fishery requirements at power dams.

The only subject passed over entirely is tidal power.

Miscellaneous Notes . . .

• **Modular bibliography**—A bibliography listing books, articles and technical papers dealing with the modular system of coordinated dimensioning for buildings and building products is available free from Modular Building Standards Association, 2029 K St. N.W., Washington 6, D. C.

• **Land development**—The Home Builders Manual for Land Development, 2nd revised edition, discusses site considerations, utility systems, lot planning, shopping centers, paving and layout of streets. The 264 page manual is available at $5 a copy from the National Association of Home Builders, 1625 L St., N.W., Washington 6, D. C.

• **ASTM standards for gypsum plaster**—Definitions, specifications and test methods pertaining to gypsum products, plaster aggregates and related materials are covered in a book prepared by the American Society for Testing Materials. The book may be obtained for $2.50 from ASTM, 1916 Race St., Philadelphia 3, Pa.

• **References**—A thesis by Lloyd E. Stiffler, Jr., entitled FENDERS AND FENDER SYSTEMS, done under the direction of Adm J. Mack Angus, CEC, USN (ret.) chairman of the Department of Civil Engineering, Princeton University, contains excellent bibliography and text material for those who need such specific information.

For a periodical specializing in the subject, one of the best is the British publication, DOCK AND HARBOR AUTHORITY.

There are few up-to-date textbooks on the subject of harbor engineering, but two will be published shortly by Charles Griffin Co., London: DOCK AND HARBOR ENGINEERING by H. E. Cornick, in three volumes, and DOCK AND HARBOR ENGINEER'S REFERENCE BOOK, by the same author.

Reports and Pamphlets

Proceedings of the Third EUSEC Conference on Education are available from Engineers' Council for Professional Development, 29 W. 39th St., New York 18, N. Y. Price $3.50. The U.S.A. Appendix to the proceedings is also available for $3.50, and both proceedings and appendix may be bought at a package price of $6.00.

RADIATION EFFECTS ON MATERIALS—VOLUME II—STP 220—140 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $3.75.

MANUAL OF ACCIDENT PREVENTION IN CONSTRUCTION, 5th Edition—Associated General Contractors of America, Inc., 20th and E Streets N.W., Washington 6, D. C. $3.25.

STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES—7th edition. American Association of State Highway Officials, Washington 4, D. C.

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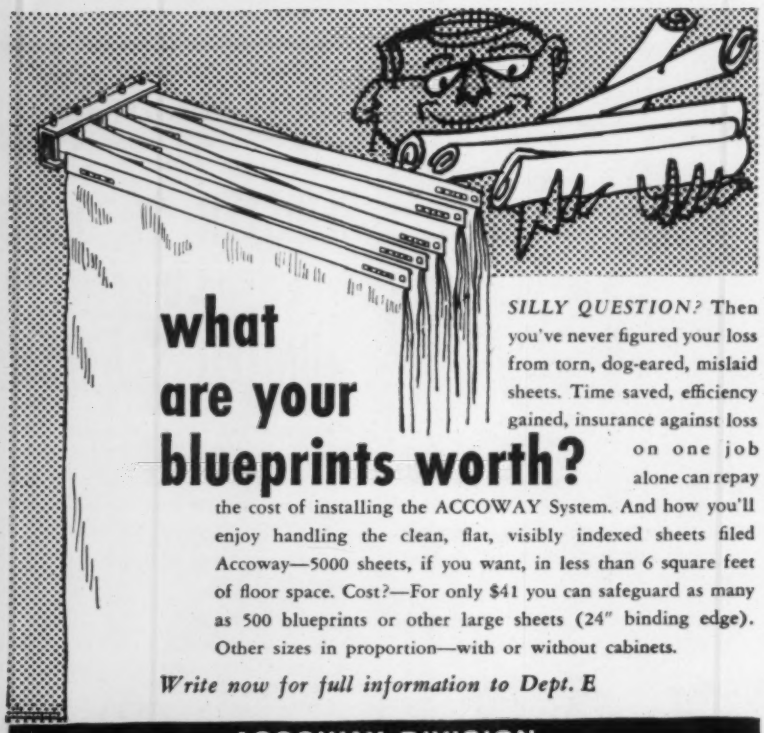

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. . . Books

(Continued from page 137)

American Planning and Civic Annual—162 pp. American Planning and Civic Association, 901 Union Trust Building, Washington, D. C. To members: $2.00; non-members: $3.00.

Fluid Mechanics—by Victor L. Streeter. 480 pp. McGraw-Hill Publishing Co., 330 W. 42nd St., New York 36, N. Y. $7.50.

Nuclear Reactor Experiments—480 pp. D. Van Nostrand Co., 257 Fourth Ave., New York 10, N. Y. $6.75.

Modern Computing Methods—129 pp. Philosophical Library, 15 E. 40th St., New York 16, N. Y. $8.75.

The Direction of Research Establishments—Philosophical Library, 15 E. 40th St., New York 16, N. Y. $12.00.

Design of Air Conditioning Systems—by F. W. Hutchinson. 336 pp. Industrial Press, 93 Worth St., New York 13, N. Y. $7.00.

Building With Tilt Up—by F. Thomas Collins. Second edition. 160 pp. F. Thomas Collins, P.O. Box 208, San Gabriel, Calif. $10.00.

Design of Tilt Up Buildings—by F. Thomas Collins. First edition. 162 pp. F. Thomas Collins, P.O. Box 208, San Gabriel, Calif. $12.50.

Theory of Structural Analysis and Design—by James Michalos. 552 pp. Ronald Press Co., 15 E. 26th St., New York 10, N. Y. $12.00.

Castilla's Spanish and English Technical Dictionary—Two Volumes. Volume I—English-Spanish; Volume II—Spanish-English. Philosophical Library, 15 E. 40th St., New York 16, N. Y. $45.00 per set.

1958 Heat Transfer and Fluid Mechanics Institute—Preprint of papers. 264 pp. Stanford University Press, Stanford, Calif. $8.50.

Toward Responsible Government—An Economic Appraisal of Federal Investment in Water Resource Programs—by Edward F. Renshaw. Idyia Press, 8342 S. Kenwood, Chicago 19, Ill.

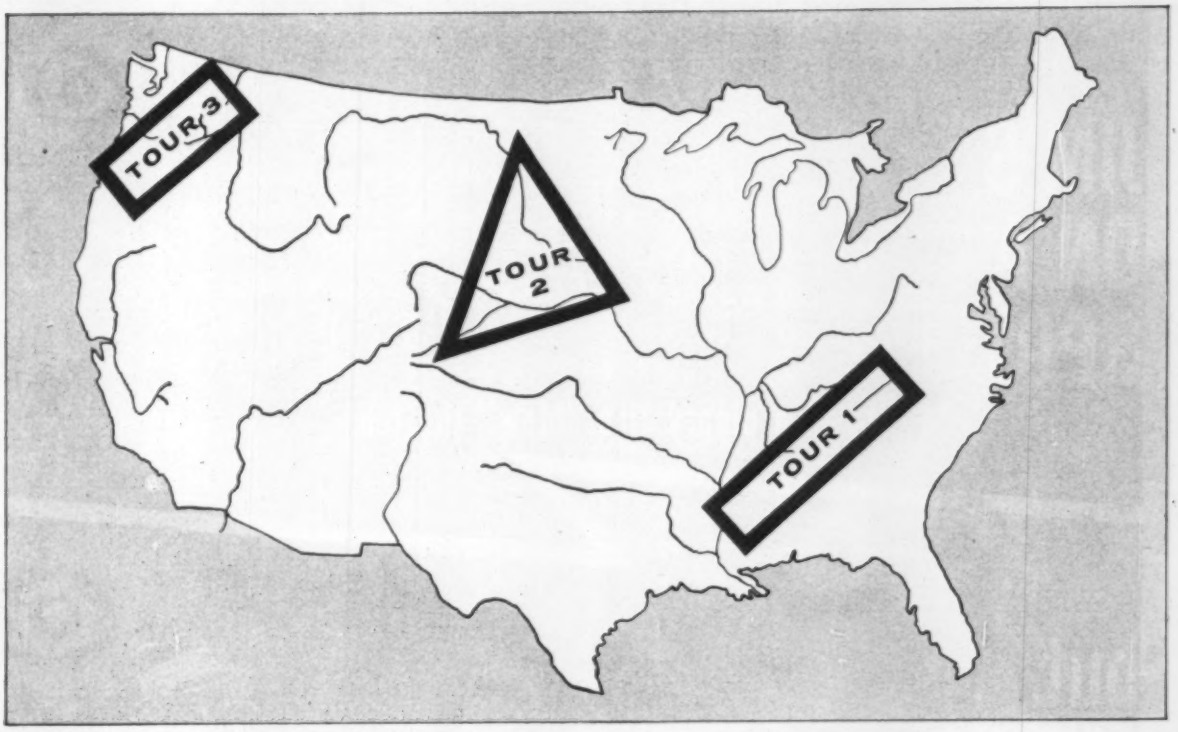
Proceedings of the Twentieth Annual Short Course for Superintendents and Operators of Water and Sewerage Systems—Bulletin No. 61. Engineering Experiment Station, Louisiana State University, Baton Rouge 3, La. $2.00.

Port Series Report No. 3—The Port of Boston, Mass.—Superintendent of Documents, Government Printing Office, Washington 25, D.C. $2.50.

Growth Survey of the Atomic Industry, 1958-1968—84 pp. Atomic Industrial Forum, 3 E. 54th St., New York 22, N. Y. $25.00.

The Underground Nuclear Detonation of September 19, 1957, Rainier, Operation Plumbbob—UCRL—5124. Office of Technical Services, Department of Commerce, Washington 25, D. C. $1.00.

International Cooperation With Respect to Water Resource Development—Doc. E/3071. United Nations Department of Public Information, Press and Publications Div., United Nations, N. Y.



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Cherokee	2—50,000 HP Francis	
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Douglas	2—35,500 HP Francis	
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Guntersville	3—39,000 HP Kaplan	
Hales Bar	2—34,000 HP Kaplan	
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Bear Creek	1—13,040 HP Francis	
Cedar Cliff	1— 9,400 HP Francis	
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TOUR 2		
Fort Peck	2—50,000 HP Francis	2 Butterfly Valves
	1—20,000 HP Francis	
TOUR 3		
Chief Joseph	6—100,000 HP Francis	
Rocky Reach	7—140,000 HP Kaplan	3 Turbine-Driven Fishway Pumps
Bonneville	10— 74,000 HP Kaplan	
	1— 5,000 HP Kaplan	
Priest Rapids	——	42 Fishway Butterfly Valves
Merwin	2— 61,600 HP Francis	
Swift #2	2— 46,000 HP Francis	
Swift #1	3—107,000 HP Francis	
Yale	2— 70,000 HP Francis	
Albeni Falls	——	Trash Rake
Brownlee	4—144,000 HP Francis	
Baker River (Lower)	1— 75,350 HP Francis	
Ice Harbor	3—143,000 HP Kaplan	
McNary	14—111,300 HP Kaplan	65 Fishway Rotovalves
Mud Mountain	——	3 Howell-Bunger Valves
Palisades	4— 39,500 HP Francis	
Pelton	3— 52,200 HP Francis	
Wishon	——	3 Butterfly Valves
		1 Howell-Bunger Valve
Courtright	——	1 Butterfly Valve
		1 Howell-Bunger Valve
Gorge	3— 45,000 HP Francis	
Diablo	?—115,000 HP Francis	

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Unit Prices

Tunnel Under Illinois Expressway

Deep tunnel, difficult form work, complicate job of carrying water mains and sewers under expressway

A tunnel section, with access manhole 43 ft ± deep, and difficult concrete form work in connection with junction chambers, make difficult construction problems for George D. Hardin, Chicago contractor, on this $162,292 job for the State of Illinois Division of Highways. R. R. Bartlesmeyer is chief highway engineer at Springfield, Ill.

A 2-pipe inverted sewer siphon includes the tunnel section, which also carries two water mains and electrical ducts under the Congress St. Expressway in Forest Park, near Chicago. The sewer is above the grade of the expressway, except where the inverted siphon carries it under the roadway.

Class X concrete requires compressive strength of 3,500 psi, 650 modulus of rupture at 14 days.

The contractor will furnish all materials. Truck transportation is available.

Wages on this job include: crane operators, $3.80; common laborers, $2.85, including fringe benefits. Crane operators' rates increased to $3.95 on June 1.

The three bids included:

1 George D. Hardin, Chicago	$162,292
2 Latrobe Engineering Co., Inc., Chicago	227,807
3 M. J. Boyle & Co., Chicago	228,516

Bids: 5-6-58 Items	Unit	Quantity	Unit Prices 1C	2
Backfill, trench	cy	1,100	$5.28	$10.00
porous granular	cy	358	4.11	10.50
Concrete, cl X	cy	195	98.09	140.00
Reinforcement bars	lb	15,949	0.14	0.15
Steel gal. misc	lb	670	1.06	0.50
CI ftgs for sewer	lb	4,298	0.41	0.22
pipe for sewer, 10"	lf	317	18.05	10.00
Riser pipe section, 36"	ea	2	3,640	6,500
Reinf conc pressure pipe, 36"	lf	303	38.16	35.50
Storm sewer, tp 2, 12"	lf	40	3.33	3.85
42"	lf	45	38.40	28.00
tp 4, 8"	lf	145	10.70	12.00
tp 2, perf, 12" radius pipe, 42" tp 2	lf	317	14.18	8.85
	lf	96	41.17	32.00
CI water pipe, 8"	lf	396	5.92	8.50
12"	lf	437	9.62	11.00
pipe fittings	lb	5,157	0.41	0.22
MH w tp 5 frame, closed lid, tp A, 5'ϕ	ea	2	293.00	500.00
access, 3'ϕ	ea	1	258.00	850.00
Catch basin, tp A, 4'ϕ w tp 1 frame, closed lid	ea	1	1,760	3,500
Gate valves, 12"	ea	2	235.00	260.00
8"	ea	2	129.00	135.00
Corp stops, 1"	ea	4	5.30	12.00
Valve vaults, tp A, w tp 1 frame, closed lid, 4'ϕ	ea	1	213.00	225.00
5'ϕ	ea	1	240.00	250.00
CI stop plank groove	lb	467	0.23	0.30
blind flanges	lb	891	0.41	0.22
Treated timber	fbm	95	2.35	190.00
Tunnel liner & excavation	lf	301	233.81	260.00
Storm sewer, tp 4, 10"	lf	7	3.34	50.00
Pavement replace	sy	90	11.73	9.00
Sidewalk remove	sf	689	0.23	0.25
Port cmt conc sidewalk, 5"	sf	689	0.59	0.75
Comb curb & gutter, remove	lf	25	1.17	1.00
tp 3	lf	25	3.81	2.50
Transformer vault	ea	1	938.00	2,700
Electrical manhole	ea	4	290.00	3,740
Conduit, asb cmt, conc encased	lf	150	11.73	16.00
in tunnel	l	290	11.73	27.00
Cable, lead cov, #8 AW, g 1/c 5000 volts	lf	3,000	0.47	0.90
Conduit, rigid steel, 4"	lf	54	9.38	10.50
Driveway pavement remove	sy	23	4.69	2.00
PCC, 8"	sy	23	7.04	7.00

Completion schedule: 130 days
Liquidated damages: Engineering costs after completion date

Wide Spread on Sewer Bids in Kentucky

This "easy, straightforward sewer job" will provide sanitary sewers for recently acquired subdivisions of Danville, Ky. J. Stephen Watkins, Lexington, Ky., is consultant.

The $93,112 award to Goodlett & Adams, Harrodsburg, Ky., includes the laying of 8 in. vitrified clay pipe with 6 in. house connections, and one pumping station. The contract is 1.6% above the engineer's estimate, but it is 27.5% below the high of the six bids.

Class B concrete is specified 3,500 psi, and Class C, 2,000 psi. Cast iron force main is 6 in. mechanical joint, ASA Standard A21.8 or A21.6, tar coated inside and outside.

The contractor furnishes all materials. Railroad and truck transportation is available, with the railroad ¾ miles from the project.

Wages on the job range from $1.75 for skilled, through $1.50 for semi-skilled, to $1.00 for common laborers. Air tool operators are paid $1.40.

The six bids included:

1C Goodlett & Adams, Harrodsburg, Ky	$93,112
2 Donlon Constr. Co., Nashville, Tenn	94,809
6 Eller Bros., Inc., Madison, Tenn	128,272

Bids: 3-21-58 Items	Unit	Quantity	Unit Prices 1C	2
VC pipe, 6" house conn	lf	3,650	$2.22	$2.35
8", cut 0-6'	lf	6,815	2.42	2.55
6-8'	lf	2,585	2.67	3.05
8-10'	lf	322	2.97	3.65
Wedge lock pipe, 8", cut 0-6'	lf	2,660	2.90	2.95
6-8'	lf	325	3.15	3.40
8-10'	lf	10	3.45	4.00
Vitrified wyes, 8"x8"	ea	150	4.00	3.90
bends, 6"-1/8	ea	150	3.50	1.95
MH, standard	ea	53	200.00	209.00
drop	ea	3	60.00	289.00
barrel extension	lf	24	20.00	19.00
CIP force main, 6", mech jt	lf	1,125	2.90	3.40
B&S, for gravity sewers, 8"	lf	20	4.00	6.00
Conc, cl C, cradle &/or encase	cy	5	35.00	30.00
Cr stn or grav, TB surfacing	t	1,150	3.50	2.80
Asph conc, paving replacement	t	96	12.50	15.00
Bit surface treatment	sy	3,315	1.00	1.05
Exc, rock, pipe line trench	cy	860	12.50	12.00
Cr stn for bedding pipe in rock trench	t	205	4.00	3.60
Access road & parking area	ls	job	400.00	1,900
Pumping station	ls	job	14,974	11,500
Conc sub slab pavement replacement, cl B	sy	100	5.00	8.30

Commence: 5-1-58. Completion schedule 200 cal days
Liquidated damages: $75/day

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Materials and Labor Prices

Market Quotations by ENR Field Reporters

See following ENR issues for OTHER PRICES:

- Wood Products, Glass, Explosives, Chemicals: Last, Aug. 21; Next, Sep. 18
- Clay Products, Lime, Plaster, Paint, Roofing: Last, Aug. 28; Next, Sep. 25
- Wage Rates, Building Board, Lath, Insulation: Last, Aug. 28; Next, Oct. 2
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IRON AND STEEL PRODUCTS—PER 100 LBS. BASE MILL PRICES

	STRUCT SHAPES—	PLATE CARBON STEEL	REINF BARS* billet	RIVETS ½-in. struc-tural	SHEET PILING Base	STEEL RAILS Per Net Ton Standard	STEEL RAILS Per Net Ton Light	TRACK SUPPLIES Angle Bars	TRACK SUPPLIES Std Spikes	TRACK SUPPLIES Tie Plates	TRACK SUPPLIES Track Bolts
Birmingham Area	$5.50	$5.30	$5.675	$12.25	.....	$110.50	$130.00	$6.975	$9.75	$6.60	.....
Chicago Area	5.50	5.30	5.675	12.25	$6.50	110.50	130.00	6.975	9.75	6.60	.....
Pittsburgh Area	5.50	5.30	5.675	12.25	6.50	110.50	130.00	6.975	9.75	6.60	$14.75
Buffalo Area	5.50	5.30	5.675	12.25	6.50	110.50	130.00	6.975	9.75	6.60	14.75
Cleveland	.....	.....	5.675	.....	.....	.....	.....	.....	.....	.....	14.75
Youngstown Area	.....	.....	5.675	.....	.....	.....	.....	.....	9.75	.....	.....
Geneva*	5.50	5.30	.....	.....	.....	.....	.....	.....	.....	.....	.....
Los Angeles	6.20	.....	6.375	.....	6.50	.....	.....	.....	9.75	6.75	.....
Pueblo	.....	.....	.....	.....	.....	.....	.....	69.75	9.75	6.60	.....

* Fairless Works, $5.575.

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS Per 100 lb., base price 5 tons to carload lot New billet	REINFORCING BARS Per 100 lb., base price 5 tons to carload lot Rail steel	EXPANDED METAL LATH‡ Per 100 sq. yd., carload lots Std. diamond mesh. 3.4 lb.	EXPANDED METAL LATH‡ Per 100 sq. yd., carload lots Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq ft., carload lots fob mill
Atlanta	$9.05	9.25	$9.01t	$52.00	$57.00	
Baltimore	9.675	8.70j	.....	42.00	46.50	
Birmingham	9.00	8.99	8.99y	57.00p	63.00p	
Boston	10.03s	8.75	8.75	46.50	51.00	
Chicago	9.15E	7.16gu	7.16gu	52.00‡	63.00‡	
Cincinnati	9.56zk	9.08rs	.....	41.50mn	46.00mn	
Cleveland	9.30	7.75c	.....	44.50‡	49.00‡	
Dallas	10.40	9.00	9.00	44.00	48.50	
Denver	9.84	8.95c	.....	57.00n	63.00n	
Detroit	9.56	7.15g	.....	45.00	63.00	
Kansas City	9.82s	8.10	.....	49.00	60.00	
Los Angeles	8.90fd	7.35	.....	57.00	63.00	
Minneapolis	9.08d	9.25b	9.25b	42.50	46.00	
Montreal	7.90–8.60aC/8.20–8.90A	7.00/7.50FG	7.00/7.50FG	65.70A	70.20A	
New Orleans	.....	8.00gks	.....	47.00	52.00	
New York	9.84‡s	8.60y	8.60y	50.50m	57.00ns	
Philadelphia	9.00/9.25	8.03/8.25	.....	42.50‡	47.00‡	
Pittsburgh	9.00y	7.10y	.....	46.00‡w	49.50‡w	
St. Louis	9.48s	8.80c	8.80c	61.00l	62.00l	
San Francisco	9.90	9.85j	.....	52.00	56.00	
Seattle	9.80aD	8.85e	.....	63.50n	68.00n	
Toronto	9.20H	7.85	7.85	46.00nqJ	49.00nqJ	

Quantity extras, per cwt: under 100#, +$2; 100-399#, +$1; 400-999#, +3.50; 1000-1999#, +1.00; 2000-4999#, base price; 5000-9999#, —10¢; 10,000-19,999#, —30¢; 20,000-29,999#, —50¢; 30,000# and up, —70¢

EXTRAS, per cwt—♦Quantity (applies to LCL shipments only): under 1,000#, +$1.80; 1000-1999#, +$1.20; 2000-4999#, +$1.00; 5000-9999#, +90¢; 10,000-19,999#, +60¢; 20,000-29,999#, +30¢; 30,000-39,999#, +10¢; 40,000# & up, none. ♦Size†: #2 +$2.50; #3 +$1.40; #4 +$1.00; #5 +70¢; #6, #7,#8, #9, #10, #11 +50¢. ♦Bending: heavy, +90¢; light +$2.20 (except in New York City and surrounding metropolitan area where bending must be done on the job). ♦Engineering (details and placing from designs by others): over 500 tons, +15¢; 200-499 tons, +50¢ but not over $4500; 75-199 tons, +65¢ but not over $2000; 20-74 tons, +75¢ but not over $975; 5-19 tons, +85¢ but not over $300; under 5 tons, +$1.00 but not over $85. Min. charge $25. Design only: +60¢.

WELDED FABRIC REINFORCING: 4 × 18 in., No. 5 & 10 wires—Joliet, Ill., Donora, Pa., Monessen, Pa.: $3.98; 4 × 12 in., No. 8 & 12 wires—Joliet, Ill., Donora, Pa., Monessen, Pa.: $2.62; 6 × 8 in., No. 6 & 6 wires—Joliet, Ill., Donora, Pa., Monessen, Pa.: $1.17

‡ Delivered. ** Aver. of Canadian & American. •a 2000-9999#. •b 10,000-15,999#, fob city •c 20 tons or over •d 10,000-29,999# •e Intermediate struct'l •f Incl. delivering in free zone •g CL •h list price; dominion tax exempt; add provincial and municipal taxes •i add dominion, provincial and municipal sales taxes •j intermediate and hard grade •k fob city •l delivered; contractor to do unloading •m copper alloy •n LCL •o asphalt coated •p del. of 500 sq. yd. or more. •q 2.5 lb •r 2% off for cash •s 2,000-4,999# •t add 16.5¢ del. •u add 7.5¢ switch •v incl 15¢ del. •w truck lots. •y add 15¢ del. •z add 10¢ del. •A American made. •C Canadian made. •D ½% for cash. •E 30,000 or over. •F Federal tax exempt. •G add 10¢ switch. •H 8.85 without tariff charges. •I 3 lb $80.00. •J 3 lb $66.00. •R: revised

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE PRICE INDEXa	ASBESTOS CEMENT PIPE per lin. ft. f.o.b. city 6" Press Cl. 150	ASBESTOS CEMENT PIPE per lin. ft. f.o.b. city 12" Sew Cl. 1500	CLAY SEWER PIPE Per ft., delivered ASTM C13-54 8 in.	CLAY SEWER PIPE Per ft., delivered ASTM C13-54 12 in.	CLAY SEWER PIPE Per ft., delivered ASTM C200-55T 24 in.	CLAY SEWER PIPE Per ft., delivered ASTM C200-55T 36 in.	CLAY DRAIN TILE† Per 1,000 ft., car load lots, f.o.b. ASTM C4-55 6 in.	CLAY DRAIN TILE† Per 1,000 ft., car load lots, f.o.b. ASTM C4-55 8 in.	CONCRETE SEWER PIPE§ Per ft., delivered ASTMC 14-55 12 in.	CONCRETE SEWER PIPE§ Per ft., delivered ASTMC 14-55 24 in.
Atlanta	130.5	$1.56/1.69	$2.36/2.48	$.53	$.98	$	$	$209.00e	$334.00	$1.55m	$4.40m
Baltimore	140.4	1.56/1.69	2.19/2.30	.665	1.28	5.08r	12.71	187.80	289.20	1.01	2.75m
Birmingham	125.8	1.56/1.69	2.26/2.37	.46	.86	3.70w	10.37w	260.00‡	440.00‡	1.25m	2.75
Boston	143.5	1.58/1.71	2.19/2.30	.784grf	1.512grf	6.225grf	.....	215.40r	330.60r	1.56mg	3.47mg
Chicago	140.9	1.56/1.69	2.19/2.30	.93m	1.78m	7.52m	21.16m	220.00n	330.00n	1.30	4.00
Cincinnati	135.5	1.58/1.71	2.19/2.30	.665t	1.2825t	4.905t	12.505	240.00	370.00	.85m	3.25m
Cleveland	141.7	1.58/1.71	2.19/2.30	.609e	1.1745e	4.995t	12.71t	131.40m	204.60m	.85m	3.50m
Dallas	137.8	1.58/1.71	2.26/2.37	.550	.955	4.40b	9.75b	.....	.....	1.21	2.57
Denver	148.2	1.79/1.80	2.36/2.48	.48n	.87n	3.73n	.....	.....	.....	.75m	2.75m
Detroit	142.1	1.58/1.71	2.19/2.30	.90n	1.70n	6.80n	18.50n	182.00m	280.25m	1.10	4.05
Kansas City	138.5	1.60/1.71	2.26/2.37	.61	1.105	5.694b	12.08	278.00	493.00	.95	2.90
Los Angeles	148.6	1.65/1.79	2.19/2.30	.74bl	1.61bl	6.42bl	15.36bl	370.00l	530.00l	1.12	3.32f
Minneapolis	149.9	1.60/1.75	2.26/2.37	.86mo	1.55mo	6.70mo	.....	.....	.....	2.13h	5.74h
Montreal	.....	.....	.....	1.13u	2.00u	7.00u	13.50u	288.00	545.00	1.17h	3.11j
New Orleans	133.3	1.56/1.69	2.26/2.37	.528	.983	5.21	.....	210.00p	468.00	.85	2.90
New York	138.7	1.58/1.71	2.19/2.30	1.02	1.94	7.58	19.48	.....	.....	1.50	3.60
Philadelphia	138.0	1.56/1.69	2.19/2.30	.68	1.31	5.13e	14.25e	300.00‡	350.00‡	1.75h	4.20h
Pittsburgh	142.9	1.58/1.71	2.19/2.30	.595m	1.15m	4.73m	12.40m	190.00	295.00	1.66z	3.93z
St. Louis	136.9	1.56/1.69	2.26/2.37	.59	1.08	4.45	10.80	180.00l	380.00l	1.45il	3.10hl
San Francisco	148.6	1.65/1.79	2.19/2.30	.78d	1.69d	6.72d	16.36d	320.00l	560.00l	1.05m	3.30m
Seattle	149.0	1.65/1.80	2.19/2.20	.72b	1.50b	6.84	.....	255.00c	.....	1.95ky	4.75ky
Toronto	.....	.....	.....	.80	1.50	6.00	.....	157.00	280.00	.92	3.21

*WROUGHT STEEL PIPE (Full standard weight) Discount from list; see footnotes

Mill	2½ & 3 in. Butt Weld* Black %	2½ & 3 in. Butt Weld* Galv. %	3½ to 6 in. Lap Weld* Black %	3½ to 6 in. Lap Weld* Galv. %	8 to 12 in. Lap Weld* Black %	8 to 12 in. Lap Weld* Galv. %
Lorain, Ohio	16.75	0.50	3.25z	+11.00z	.....	.....
Alburquirque, Pa	13.75	Inset	.....	.....	.....	.....
Sparrows Pt., Md	17.25	1.00	.....	.....	.....	.....
Benwood, W. Va	13.75	+2.50	3.25	+13.50a	3.25a	+13.50a
Youngstown, O	13.75	+2.50	2.25ab	+14.50a	.....	.....
Indiana Harbor, Ind.	13.75	+3.50	.....	.....	3.25a	+13.50a
Sharon, Pa	13.75	+2.50	3.25z	+13.50a	.....	.....
Wheatland, Pa	13.75	+2.50	1.50d	+12.75a	.....	.....
Elms, Pa.	13.75	Inset	1.50d	+12.75a	.....	.....
Fontana, Calif	0.75	+15.50	+9.25ab	+26.50ab	.....	.....

* Threaded and coupled. a 2½ to 4 in. b Continuous weld. c 1 to 1 5 and 6 in. d 6 in. † Production discontinued

•† Extra quality •‡ delivered. •a PRICE INDEXES for CENTRIFUGAL CAST IRON PIPE (Include carload freight allowed to city). These also serve as the HISTORICAL RECORD of THE $ PER NET TON PRICE of CLASS B, B&S, PIT CAST IRON PIPE. F.O.B. Foundry Price Indexes Birmingham, Ala., 125.8; Burlington, N. J., 134.6. •b Extra strength. •c 4-in., $140. •d SS361-A •f 21 in. •g culvert pipe; reinf., ASTM C 75-56 •h reinf., ASTM C 75-54 •i reinf., ASTM C 76-55 •j centrispun; no standard specs. in Canada. •k 2% cash •l fob plant •m truck del. •n LCL del., fob truck •o listed price based on LCL (no min.) •p freight allowed to destination in city •q ASTM C 13-40 •r CL fob origin, freight allowed •s 1 ft lengths •t 3 ft lengths •u CESA A 60-1941 •v standard strength •w SS; add 20% for d.s. •x fob city •y Reinforced •z Upper value in range estimating price based on both truck lots and less than truck lots; lower value truck lot quantities

* WROUGHT STEEL PIPE: Deduct discounts shown above from the following standard list consumers carload prices to get mill price. List prices per ft.("based on approx. $200 per net ton): Butt Weld ⅛ in., 8½¢; ¼ in., 8¢; ⅜ in., 8¢; ½ in., 8½¢; ¾ in., 11½¢; 1 in., 17¢; 1¼ in., 23¢; 1½ in., 27½¢; 2 in., 37¢; 2½ in., 58½¢; 3 in., 78½¢. Lap Weld 3½ in., 92¢; 4 in., $1.09; 5 in., $1.48; 6 in., $1.92. Add freight, 3% transport tax for destination price. † Production discontinued November 1957

WROUGHT IRON PIPE: List prices per ft. same as for wrought steelpipe, but add following "discounts" to get Pittsburgh mill price: Butt Weld—1 in. black, + 65.54, galv., + 95.77; 1¼ in. black, + 65.54, galv. + 95.23, 1½ in. black, + 61.79 galv. + 91.22; Lap Weld —2½ in. to 3 in. black + 67.95 galv. + 95 77; 4½ in. to 6 in. black + 64.74 galv. + 90.68 Add freight rates plus 3% transportation tax to get destination price.

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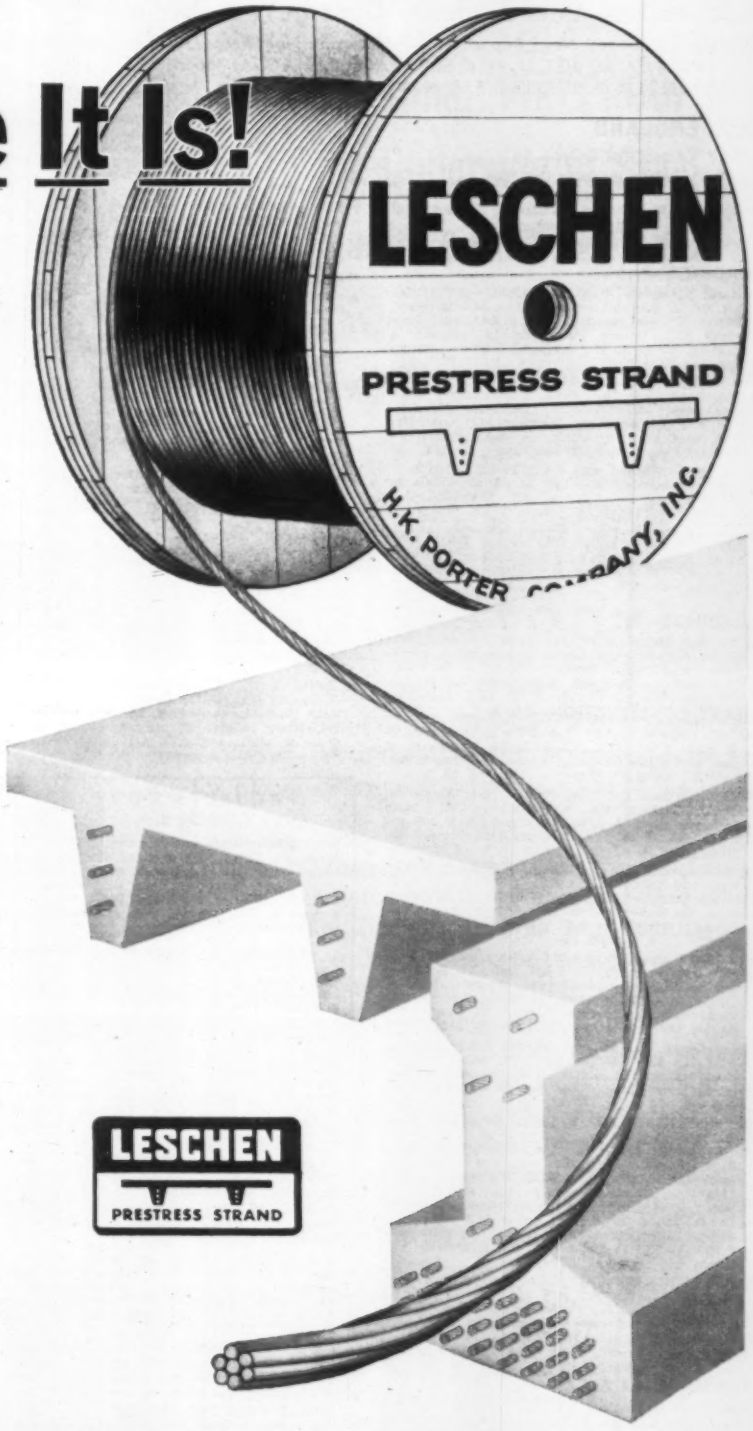

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Construction Reports

Bids Asked—Low Bidders—Contracts Awarded—

Compiled by Business News Department—Engineering News-Record, 330 W. 42nd St., New York 36, N. Y., ELSIE EAVES, Manager
J. A. MAHONEY, M. WETZEL, M. E. SCIORRA, D. TARTAGLIA, Reports
J. H. WEBBER, M. R. ROESSLER, E. R. HUBER, Statistics.

NEW ENGLAND

HEAVY CONSTRUCTION—BA

STATE HIGHWAY LETTINGS
BRIDGES
September 16 Massachusetts September 22 Connecticut
STREETS AND ROADS
September 16 Massachusetts September 22 Connecticut

BUILDINGS—BA

▲ **Mass., Springfield**—PARKING GARAGE—BA 9/17—City, Off-St. Parking Comn., City Hall, parking garage, Hillman St. and Harrison Ave. $1,062,500. Plans deposit $50. Munson, Mallis, Bradley, Patterson & Burgener, 6 Frost St., Springfield, Mass., archts.-engrs. CD 9/11/51.

Conn., Ellington—SCHOOL—BA 9/18—Town, High School Bldg. Comn., c/o Town Clerk, 1 story, steel, brick, blocks high school, Maple St. $812,000. Plans deposit $50. Golden-Storrs Assocs., 1232 Farmington Ave., West Hartford, archts. A. John Macchi, 75 Farmington Ave., West Hartford, engr. CD 5/2.

Mass., Lynn—SCHOOL, etc.—BA 9/18—St. Pius R. C. Church, Chancery Office, 1 Lake St., Brighton (selected list of bidders) school and convent. $360,000. John M. Gray Co., 153 Milk St., Boston, archt. CD 3/11.

▲ **Mass., Plymouth**—HOSPITAL—BA 9/30—Jordan Hospital, Sandwich St., Plymouth, hospital, Sandwich St. $1,000,000. Plans deposit $100. James H. Ritchie & Assoc., 135 Clarendon St., Boston, Mass., archts. CD 8/12, under LB.

BUILDINGS—SLC

▲ **N. H., Exeter**—HOSPITAL—Exeter Hospital Inc., Buzzell Ave., soon lets contract hospital addns., alterations. $1,000,000. Kendall, Taylor & Co., Inc., 12 Norfolk St., Cambridge, Mass., archt. CD 8/18.

HEAVY CONSTRUCTION—LB & CA

MAINE—State Hy. Comn., State Office Bldg., Augusta,
C. R. West, Errol, N. H., CA **$296,076** (4 bidders), b. conc. road 3.295 mi. (stage construction) incl. bridge. FASP No. S-0181(3), Rangeley. Bids Aug. 27.

VERMONT—State Dpt. Hys., State House, Montpelier,
Ralph B. Goodrich, Inc., 211 Hinesburg Rd., South Burlington, Vt., CA **$338,733,** highway $350,000 and bridge Route 107, est. DF-022-1(3), Bethel Co. CD 6/17/53.

▲ **MASSACHUSETTS**—Commonwealth of Mass., Dpt. P. Wks., 100 Nashua St., Boston,
Suburban Excavators, Inc., 4 New Salem St., Wakefield, Mass., CA **$2,346,543,** hy. and bridge constr. proposed Interstate Rd. 91, FA 1-91-1(4)48, Bernardston. Bids Aug. 5. CD 8/8, **under LB.**

Calco Contg, Inc., 370 Lowell St., Worcester, Mass., CA **$201,010,** est. $200,000, F-801 Contr. No. 2, building and grading, Lake Quinsigamond, Worcester, MASSACHUSETTS. Commonwealth of Mass., Dpt. Natural Resources, c/o Div. Bldg. Constr., 38 Chauncy St., Boston, Mass. Bids July 10. CD 7/18, **under LB.**

James Constr. Co., Inc., 14 Boylston Place, Brookline, Mass., LB **$277,338,** est. $300,000, sewage treatment plant and pumping station, IPSWICH, MASS. Town, Sewage Constr. Comn., Town Hall, Ipswich, Mass. Bids Aug. 20. CD 8/5.

▲ **CONNECTICUT**—State Hy. Dpt., State Office Bldg., Rm. 527, Hartford,
M. A. Gammino Constr. Co., 782 Valley St., Providence, R. I., **Brunalli Constr. Co. Inc.,** 109 Summer St., Southington, Conn., CA **$2,507,274** (joint award), 11,074 lin. ft. hot b. conc. pavement reloc. Route 9 incl. 2 grade structures, etc., Griffin Brook and 10,607 lin. ft. hot c. conc. reloc. Routes 187 and 4 span welded plate girder bridge over Farmington River Projs. 11-72, 11-87 and 11-89 Bloomfield, East Granby and Simsbury. CD 7/14.

CONNECTICUT—State Hy. Comr., 165 Capitol Ave., Hartford,
Mariani Constr. Co., 222 Forbes Ave., New Haven, Conn., CA **$791,484,** 3 span welded girder bridge over Naugatuck River, Main St., Route 34, incl. 1,422 lin. ft. c. conc. pavement, Derby. Bids 7/7. CD 7/11.

BUILDINGS—LB & CA

Consolidated Constructors, Inc., 807 Congress St., Portland, Me., CA Est. **$350,000,** CHURCH, HOULTON, ME. St. Marys of the Visitation Parish, c/o Bishop of Portland, 317 Congress St., Portland, Me. Alfred Reinhardt, 1387 Main St., Springfield, Mass., archt. CD 8/20, under LB.

Gordon & Sutton, 227 Houghton St., North Adams, Mass. LB **$360,000,** LIBRARY, BENNINGTON, VT. Bennington College, Business Mgr., Bennington, Vt. Bids Aug. 26. CD 8/12, under Public Bldgs.

Scott-McNeilly & Son, 35 Webster St., Brookline, Mass., CA, Est. **$500,000,** OFFICE BLDG., BROOKLINE, MASS. Texaco, 616 Statler Bldg., Boston, Mass. Bids July 14. CD 6/27.

M. J. McGuire & Co., Inc., 856 North Main St., Randolph, Mass. Separate Contracts. **$350,000,** RESIDENTIAL DEVELOPMENT "Ledgewood Park," 16 houses, York St.; Separate Contracts, **$345,000,** RESIDENTIAL DEVELOPMENT "Onkapoag Hill," 15 houses, Randolph St., CANTON, MASS.

† **B. Letendre & Sons Co.,** 38 Kingoke Lane, Springfield, Mass., LB **$334,671,** est. $300,000, off-site utilities, Westover Air Force Base, Inv. 19-617-59-1, CHICOPEE FALLS, MASS. Base Procurement Office, Bldg. T-273, Westover Air Force Base, Chicopee Falls, Mass. Bids Aug. 25. CD 8/20.

▲ **Grande & Son, Inc.,** 175 Maplewood St., Malden, Mass., LB **$2,732,422,** est. $2,225,000, REGIONAL HIGH SCHOOL, Rte. 2 and Walden St., CONCORD, MASS. Towns Concord and Carlisle Regional School Dist., Concord High School Auditorium, Stowe St., Concord, Mass. Bids Aug. 29. CD 8/20.

Rocheford Constr. Co., Inc., 227 W Central St., Natick, Mass., LB **$477,777,** Contr. No. 302, ELEMENTARY SCHOOL, Juniper Hill off Upper Joslyn Ave., FRAMINGHAM, MASS. Town, Chn. Bldg. Comn., Administration Bldg., Lexington St., Framingham, Mass. Bids Aug. 26. CD 7/31.

Ludlow Hospital Society, Bd. Trustees, 14 Chestnut St., Wilbraham, Mass., cancelled bids to have been opened Sept. 15, hospital, WILBRAHAM, MASS., **$750,000.** Will re-advertise. CD 8/18.

J. L. Marshall & Sons, Inc., 560 York Ave., Pawtucket, R. I., LB **$817,100.** JUNIOR HIGH SCHOOL, Middle Hy. and Lincoln Ave., BARRINGTON, R. I. Town, Frederick Thomas School, Admin. Bldg., Barrington, R. I. Bids Aug. 26. CD 8/11.

E. Turgeon Constr. Co., Inc., 42 Weybosset St., Providence, R. I., LB **$829,842.** HOSPITAL, 200 Wampanaug Ave., EAST PROVIDENCE, R. I. Hattie Ide Chaffee Memorial Hospital, 891 Broadway, East Providence, R. I. Bids Aug. 28. CD 8/8.

▲ **Cantor Constr. Co.,** 185 Corey Rd., Brookline, Mass. CA Approx. **$1,000,000.** SHOPPING CENTER, WARWICK, R. I. Murray Fennard, 36 Metacomet Rd., Newton, Mass. Saisberg & LeBlank, 318 Harvard St., Brookline, Mass., archts. CD 3/12/57, under Muradian Realty Trust Co., as owner.

PROJECTS COVERED

By Size

Construction projects here reported cover the United States and Canada, are of these minimum sizes or larger: water supply, earthwork, waterways $44,000; other public works $73,000; industrial buildings $93,000; other buildings $344,000. Also Foreign projects of $100,000 and more in size of Interest to American contractors.

By Regions & Classes of Construction
(In order of Listing)

BIDS ASKED
LOW BIDDERS
CONTRACTS AWARDED
New England — Middle West
Middle Atlantic — West of Mississippi
South — Far West

PROPOSED WORK
Water Supply — Public Buildings
Sewers, Waste Disposal — Mass Housing
Bridges — Commercial Buildings
Streets & Roads — Industrial Buildings
Earthwork, Waterways — Unclassified

In These Stages

PROPOSED WORK: Before and including appointment of engineers or architects.

BIDS ASKED: BA (new announcements only). For full calendar, see also preceding issues.

SOON LETS CONTRACT: SLC

LOW BIDDERS: LB On jobs below $500,000 in value all low bidder news will be the final reports published on the projects involved except where award is not made to the low bidder. In this case, a supplementary contract award report will be published.

CONTRACTS AWARDED: CA Except awards to low bidders previously reported in low bidder stage.

CD dates shown are of Construction Daily Issue in which last previous report was published.

OWNERS, ENGINEERS, ARCHITECTS, CONTRACTORS are invited to report their new jobs for listing in these reports when they meet or exceed the size minimums shown above. Address these news releases to J. A. Mahoney, REPORTS, ENGINEERING NEWS-RECORD, 330 W. 42 St., New York 36, N. Y.

Symbols and Abbreviations Include:

† Federal Government
▲ Project of $1,000,000 or over
ENR Engineering News-Record
CD Construction Daily

For additional reports see Construction Daily.

Topstone Development Corp., Topstone Dr., Bethel, Conn., Owner Builds, **$466,200.** 42 HOUSES, "Rockwheel Acres," Greenwood Ave., BETHEL, CONN.

Leo McManus, Shelter Rock Rd., Danbury, Conn., CA **$500,000,** 40,000 sq. ft. WIRE MFG. PLANT, Shelter Rock Rd., DANBURY, CONN., Viking Wire Co., Inc., 13 River St., Danbury, Conn. CD 7/17.

Monaco Constr. Co., 104 Reservoir Ave., Bridgeport, Conn., LB **$366,300** (8 bidders), NURSING WING addn., Milford Hospital, MILFORD, CONN. Milford Hospital, 2047 Bridgeport Ave., Milford, Conn. Bids Aug. 21. CD 8/13.

Alexander Schnip & Sons, Inc., 107 Forest St., Norwich, Conn., CA **$666,500,** Proj. BI-R, 160 CLASSROOM BLDG., New Britain State Teachers College, NEW BRITAIN, CONN. State P. Wks. Comr., 165 Capitol Ave., Hartford, Conn. Awarded Aug. 28. CD 8/20, under LB.

Dean Constr. Co., Inc., 29-28 41 Ave., Long Island City, N. Y. CA **$883,570** est. $800,000 1 story, West ELEMENTARY SCHOOL, NEW CANAAN, CONN., Town, Town Hall, New Canaan, Conn. Bids Aug. 26. CD 7/6.

Max Soloff, Post Rd., Norwalk, Conn., Owner Builds, **$481,000,** 1 story, masonry, steel FACTORY BLDG., Post Rd., NORWALK, CONN. CD 7/11.

Victor S. Atkins, 106 Sylvan Ave., Waterbury, Conn., LB **$509,995** (5 bidders), Proj. BI-B-121, 2 and 3 story, 71 x 200 ft., brick, cinder block PERSONNEL BLDG., Southbury State Training School, SOUTHBURY, CONN., State P. Wks. Dpt., 165 Capitol Ave., Hartford, Conn. Bids Aug. 27. CD 8/6.

Winick & Pearlman, Inc., 9 Center St., Hartford, Conn., CA **$600,000,** COMMERCIAL BLDG., retail stores and Bishop's Corner Station of Hartford Post Office, 2480 Albany Ave., WEST HARTFORD, CONN. Milton Gladstein, 2480 Albany Ave., West Hartford, Conn. Kane & Fairchild, 734 Asylum Ave., Hartford, Conn., archts. Jacob Koton Assocs., 153 Homestead Ave., Hartford, Conn., engrs. Awarded Aug. 28. CD 8/7.

MIDDLE ATLANTIC

HEAVY CONSTRUCTION—BA

STATE HIGHWAY LETTINGS
BRIDGES
September 16 Maryland
STREETS AND ROADS
September 16 Maryland

▲ **Pa., Enola**—BA 9/29—East Pennsboro Twp. Auth., 243 W. Columbia Rd., sanitary sewerage sys. Part A sewer lines, Part B treatment plant and pumping station. $1,600,000. Plans deposit $50. Part A, $35, Part B. Gannett, Fleming, Corddry & Carpenter, Inc., 600 N. 2nd St., Harrisburg, engr. CD 12/26/56.

Pa., Pittsburgh—PARKING AREA, etc.—BA 10/1—General State Auth., 18th and Herr Sts., Harrisburg, parking area and flag bastion in Point State Park at Pittsburgh's Triangle. $220,000. Plans deposit $10. J. A. Renner, 902 Wood St., Zone 21, archt. A. F. Jones, c/o owner, ch. engr. CD 11/25/55.

BUILDINGS—BA

N. Y., Buffalo—SCHOOL—BA 9/19—Bd. Educ., 801 City Hall, Zone 2, Grover Cleveland High School addn. $900,000. Plans deposit $25. Paul, Hauk & Welch, 250 Delaware Ave., Zone 2, archt. CD 6/6.

† **N. Y., West Milton**—PROTOTYPE OPERATION FACILITY—BA 9/19—Atomic Energy Comn., Schenectady Naval Reactors Operations Office, P. O. Box 1069, Schenectady, prototype operation facility, Knolls Atomic Power Laboratory. Inv. No. AE-59-SCH-298. $200,000-$300,000. CD 6/3.

▲ **N. Y., New York**—SCHOOL—BA 9/23—Bureau Constr., 42-15 Crescent St., Long Island City, general constr., plumbing and drainage, heating and ventilating, electrical work and lighting fixtures for new addn. to and modernization and conversion of existing Public School 51 to Junior-High School, 158th St., Jackson and Trinity Aves., Bronx Boro. Plans deposit $25 general, $25 each for trades. CD 5/16.

▲ **N. Y., New York**—SCHOOL—BA 9/24—Bureau Constr., 42-15 Crescent St., Long Island City, general constr., plumbing and drainage, heating and ventilating and electrical work and lighting fixtures for modernization and conversion of Junior High School 99, 1st Ave. and E. 100th St., Manhattan Boro. Plans deposit $25 general, $10 each for trades. CD 9/9.

Pa., Cheyney—INDUSTRIAL ARTS—BA 10/1—General State Auth., 18th and Herr Sts., Harrisburg, industrial arts bldg. and utility expansion and constr. dining hall and kitchen. $440,000. Plans deposit $10. Gleeson & Mulrooney, 1612 Market St., Phila., Zone 3, archts. A. F. Jones, c/o owner, ch. engr. CD 2/4.

▲ **N. Y., Eastchester**—SCHOOLS—BA 10/15—Bd. Educ., addn. to Ann Hutchinson, Waverly and Green-

(Continued on page 146)

A New "FIRST" on New York's Skyline!

Deering-Milliken & Co. Inc. Building, New York City's first machine-applied direct-to-steel fireproofing job. Architect: Carson & Lundin, New York, N.Y. General Contractor: Turner Construction Company, New York.

Zonolite and modern plaster machines were used to fireproof steel floors and beams. Plastering Contractor: E. B. Carley & Company, Jackson Heights, New York.

Zonolite is tops with plasterers. "I use Zonolite wherever vermiculite is specified," says Plastering Contractor E. B. Carley, above left, talking to Zonolite representative. "Zonolite is always absolutely uniform, sure to do the best kind of job."

for The First Time...FIREPROOFING Direct to the Underside of Steel Floors—"Machine-Gun" Applied!

New Advanced Technique Surpasses Fire Rating Requirements... Speeds Work Progress... Reduces Material Costs!

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MAKES HISTORY!

In the new Deering-Milliken & Co. Inc. Building, Zonolite vermiculite fireproofing was "machine-gunned" directly to the underside of steel floor decking for fire protection. It's the first job of its kind in New York.

Zonolite and the machine technique made it feasible to achieve substantial savings in time and materials. Other benefits of this new technique: Reduction in floor height; ease of tenant and mechanical changes; 4-hour fire protection. Zonolite and the speedy plaster machines were hailed as "accelerators in the coordination of the trades"—a further contribution to over-all efficiency and economy.

What happened in New York is happening in many other cities, as architects and engineers make use of new Zonolite direct-to-steel fireproofing. Get the whole Zonolite story! Tear out the coupon.

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Please send me booklet PA-41 on Zonolite Plaster, Acoustical and Fireproofing systems.

Name_____

Firm_____

Address_____

City_____ Zone_____ State_____

(Continued from page 144)

yale Elementary Schools. $1,200,000. Knappe & Johnson, 2 Overhill Rd., Scarsdale, archts. CD 4/10.

HEAVY CONSTRUCTION—LB & CA

▲ **NEW YORK**—Dpt. P. Wks., State Office Bldg., Albany, Bids opened 8/28,

N. Y.—**Peckham Road Corp.**, 50 Haarlem Ave., White Plains, N. Y., LB **$261,104** (4 bidders), reconstr. 1.1 mi. section Rte. 385, in village of Athens, Greene Co.; LB **$163,250** (4 bidders), resurf. 4.4 mi. section Rte. 214 between Edgewood and Rte. 23A, both in Greene Co.;

N. Y.—**Thomas P. Spagnoletti Constr. Co.**, 108 Main, Binghamton, N. Y., LB **$307,398** (1 bidder) reconstr. 0.65 mi. section New Court Rd. (Rte. 298) from Syracuse city line northwestward to Town Line Rd., Onondaga Co.; LB **$402,540** (11 bidders), 0.45 mi. incl. plate girder bridge over Hudson River at the Glen, Rte. 28, Warren Co.;

N. Y.—**Rusciano Constr. Corp. & Del Balso Constr. Corp.**, Pelham Manor, N. Y., LB **$5,081,493** (3 bidders), constr. and alteration portion of Major Deegan Expressway between point near Park Ave. and east St. Ann's Ave., Bronx Co.;

N. Y.—**Ador & Booth, Inc.**, 1130 Water, Watertown, N. Y., LB **$434,964** (10 bidders), wid'n., resurf. 3.4 mi. section Rte. 12F from Rte. 179 intersection just south of Dexter eastward to Brownville, Jefferson Co.;

N. Y.—**Slattery Contg. Co., Inc. & Slattery Tunnel Corp.**, 46-36 54th Rd., Maspeth, N. Y., LB **$9,968,528** (9 bidders), constr. portion Bruckner Expressway between St. Ann's Ave. and East 141 St., Bronx Co.;

N. Y.—**Johnson Drake & Piper, Inc.**, 86 Trinity Place, New York, N. Y., LB **$2,548,598** (5 bidders), decking and paving high-level Fuhrmann Blvd.-Hamburg Turnpike (Rte. 5) viaduct and approaches over Union Ship Canal on south edge of Buffalo, Erie Co.;

N. Y.—**Central Highway Corp.**, 130 Headson Dr., East Syracuse, New York, LB **$188,371** (5 bidders), reconstr. 3.38 mi. section Rte. 11 starting Oneida River Bridge near Brewerton and extending northward to Dry Bridge Road south of Central Square, Oswego Co.;

N. Y.—**The Callanan Rd. Imprvt. Co.**, Quarry, South South Bethlehem, N. Y., LB **$1,291,927** (4 bidders), wid'n., resurf. 10 mi. section Rte. 17K, starting at new Rte. 17 Expressway intersection east of Bloomingburg and extending eastward thru Bullville to Montgomery, Orange Co.;

N. Y.—**D. E. Electric Co., Inc.**, 82 Chestnut, Rockville Centre, New York, LB **$79,310** (3 bidders), furnishing, erecting directional signs and lampposts for Sunrise Hy.-Merrick Rd. interchange in Lynbrook and Rockville Centre, Nassau Co.;

N. Y.—**Chenango Corp.**, 300 E. Hiawatha Blvd., Baldwinsville, N. Y., LB **$623,007** (6 bicders) reconstr. 7.8 mi. section Rte. 31 from Cicero eastward to county line near Bridgeport, Onondaga Co.;

N. Y.—**H. W. Keeney, Inc.**, Canandaigua, N. Y., LB **$157,826** (7 bidders) reconstr. 1.51 section Rte. 36 starting at Livingston-Steuben county line and extending north beyond Jefferson St. intersection in Dansville, Livingston Co.;

N. Y.—**Steve Brody, Inc.**, 520 Broadway, Lynbrook, N. Y., LB **$77,273** (8 bidders) landscaping and misc. work along Vestal Ave. By-pass, Court St., Rte. 17 connection and Brandywine Ave. extension in Binghamton, Broome Co.;

N. Y.—**Rapone Contg. Corp.**, Fulton St., Farmingdale, N. Y., LB **$2,534,083** (4 bidders) constr. 2.6 mi. Sunrise Hy. extension from Yaphank Ave., Brookhaven to Upton Blvd., Cont. 2, Rte. 27, Suffolk Co.;

N. Y.—**Brunner Asphalt & Constr. Co., Inc.**, 237 Kingston Ave., Buffalo, N. Y., LB **$526,972** (4 bidders) resurf. 3.11 mi. section Rte. 20 starting at 18-mile Creek Bridge near North Evans and extending northeastward to Pleasant Ave., Erie Co.;

N. Y.—**Bero Constr. Corp.**, Waterloo, N. Y., LB **$628,655** (6 bidders) 9 in. c. conc. pavement, misc. work, comp. girder bridge 1.14 mi. Rte. 31 over Erie Canal on new location east of Holley, Monroe and Orleans Counties;

N. Y.—**Peerless Constr. Co., Inc.**, Scarsdale, N. Y., LB **$639,909** (6 bidders) b. conc. 0.2 mi. railroad separation to carry Michigan Ave. over Niagara Thruway and New York Central Railroad tracks in Buffalo, Erie Co. CD 8/11.

▲† **Gahagan Dredging Corp.**, 90 Broad St., New York 4, N. Y., LB **$1,102,949** (7 bidders) dredging to depth of 35 ft. below mean low water, removing 1,500,000 cu. yd. place measurement all material except ledge rock from New York and New Jersey Channels, Section 4, Areas 6 and 10, CIVENG-30-075-59-10, NEW YORK and NEW JERSEY. U. S. Eng., 111 E. 16 St., New York 3, N. Y. Bids Aug. 28. CD 8/27.

NEW JERSEY—New Jersey Turnpike Auth., Administration Bldg., New Brunswick,

Whitmyer Bros., RFD 3, Hammonton, N. J., CA **$377,347**, barrier to be erected in the center of the median strip on the Turnpike between Warwick Road at mile post 28.2 and a point north of Rancocas Creek at mile post 41.2, Camden and Burlington Counties. Bids Aug. 14. CD 7/25.

▲ **PENNSYLVANIA**—Pa. Hy. & Bridge Auth., 506 North Office Bldg., Harrisburg, Bids opened 8/29,

Pa.—**Bero Constr. Corp.**, Box 70, West River Rd., Waterloo, N. Y., LB **$4,545,902**, est. $5,000,000 (4 bidders) 22,598 ft. divided hy. c. conc. variable in width each side medial area; 2 bridges; 7 grade separations, a section Erie Thruway (Proj. 809-1) FAI North East Twp., Erie Co.;

Pa.—**Gasparini Excavating Co., Inc.**, 1439 Main St., Peckville, Pa., LB **$2,228,794**, est. $2,000,000 (7 bidders) 19,336 ft. divided hy. c. conc. 24 ft. wide each side 60 ft. earth divisor, 5 bridges, section Scranton-Binghamton Thruway (Proj. 819-1) FAI Scott, Benton and Greenfield Twps., Lackawanna Co.;

Pa.—**James D. Morrissey, Inc.**, 9119 Frankford Ave., Phila. 14, Pa., LB **$3,306,849**, est. $5,000,000 (6 bidders) 27,717 ft. divided hy. c. conc. 24 ft. wide each side earth divisor, 5 bridges Wind Gap By-Pass, L.R. 796 (1) (Proj. 723-1) Plainfield, Hamilton and Ross Twps., Monroe and Northampton Counties. CD 8/12.

▲ **PENNSYLVANIA**—Pa. Hys. Dpt., 506 North Office Bldg., Harrisburg, Bids opened 8/29,

Pa.—**Buckley & Co., Inc.**, 1317-21 S. Juniper St., Phila. 47, Pa., LB **$4,384,657** (8 bidders) 3,152 ft. Roosevelt Blvd. Extens. concrete and steel viaduct and divided hy. c. conc. roadway, 27 ft. one side, 36 ft. one side, L.R. 67058(4) Phila., Phila. Co.;

Pa.—**James D. Morrissey, Inc.**, 9119 Frankford Ave., Phila. 14, Pa., LB **$2,944,312** (5 bidders) 18,232 ft. divided hy. c. conc. 24 ft. wide each side divisor, 10 bridges, T.R. 152, Cheltenham and Springfield Twps., Montgomery Co.;

Pa.—**Bracken Constr. Co.**, Sligo, Pa., LB **$599,552** (7 bidders) 11,768 ft. crushed aggreg. base with bit. surf. 20 ft. wide, 1 bridge, T.R. 128, S. Buffalo and Cadogan Twps., Armstrong Co.;

Pa.—**Ralph V. Daniels, Inc.**, R.D. 1, Mechanicsburg, Pa., LB **$614,035** (5 bidders) 29,216 ft. crushed aggreg. base with bit. surf. variable in width, T.R. 114, Upper Allen and Silver Spring Twps., Mechanicsburg Boro, Cumberland Co.;

Pa.—**Thomas A. Mekis**, R.D. 2, Valencia, Pa., LB **$942,429** (5 bidders) 20,263 ft. c. conc. road variable in width, T.R. 62, Pine Grove Twp., Warren Co.;

Pa.—**John E. Boyer**, R. D. 2, Washington, Pa. LB **$595,088** (11 bidders), 21,084 ft. crushed aggreg. base with bit. surf. 22 ft. wide, 2 bridges, W. Pike Run and Fallowfield Twps., Washington Co.;

Pa.—**Harrison Constr. Co.**, 1101 Western Ave., Pittsburgh 33, Pa. LB **$85,493** (3 bidders) 11,111 ft. resurf. existing East St., with bit. surf. variable in width, L.R. 805 (5) Pittsburgh, Allegheny Co.;

Pa.—**H. J. Williams Co., Inc.**, 150 S. Sumner St., York, Pa. LB **$425,861** (6 bidders), 13,045 ft. crushed aggreg. base with bit. surf. 24 ft. wide, T.R. 74, Peach Bottom Twp., York Co. CD 8/11.

PENNSYLVANIA—Pa. Hys & Bridge Auth., 506 North Office Bldg., Harrisburg,

The Interstate Amieslite Corp., Rte. 202, Concordville, Pa., CA **$854,305**, est. $650,000, 50,473 ft. crushed aggreg. base with bit. surf. variable in width; wid'n. existing road, 3 bridges, Proj. 714-1, Gaines, Hippen and Delmar Twps., Tioga Co. Bids July 24. CD 7/28, under LB.

DELAWARE—State Hy. Dpt., Hy. Admin. Bldg., Dover, **Wilson Contg. Co.**, Dupont Blvd. and State Rd., New Castle, Del., CA **$777,778**, constr. addn. traffic lane along Route 14, or the Rehoboth Highway at

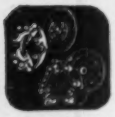
(Continued on page 148)

ROCKFORD

MORLIFE® CLUTCHES

Help Heavy-Duty Tractors Keep "Busy at Both Ends"

Because ROCKFORD Morlife® CLUTCHES provide 100% more torque grip than previous type clutches of equal size, they help road machines do double duty. Easier operation is accomplished by reducing the required engaging pressure. 50% better heat disposal avoids down-time caused by burned or warped plates. Numerous maintenance records prove that MORLIFE clutches operate four to ten times as long without adjustment or plate replacement. Let this NEW type clutch help keep your heavy-duty machines ON the job and OUT of the shop.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Gives dimensions, capacity tables and complete specifications. Suggests typical applications.

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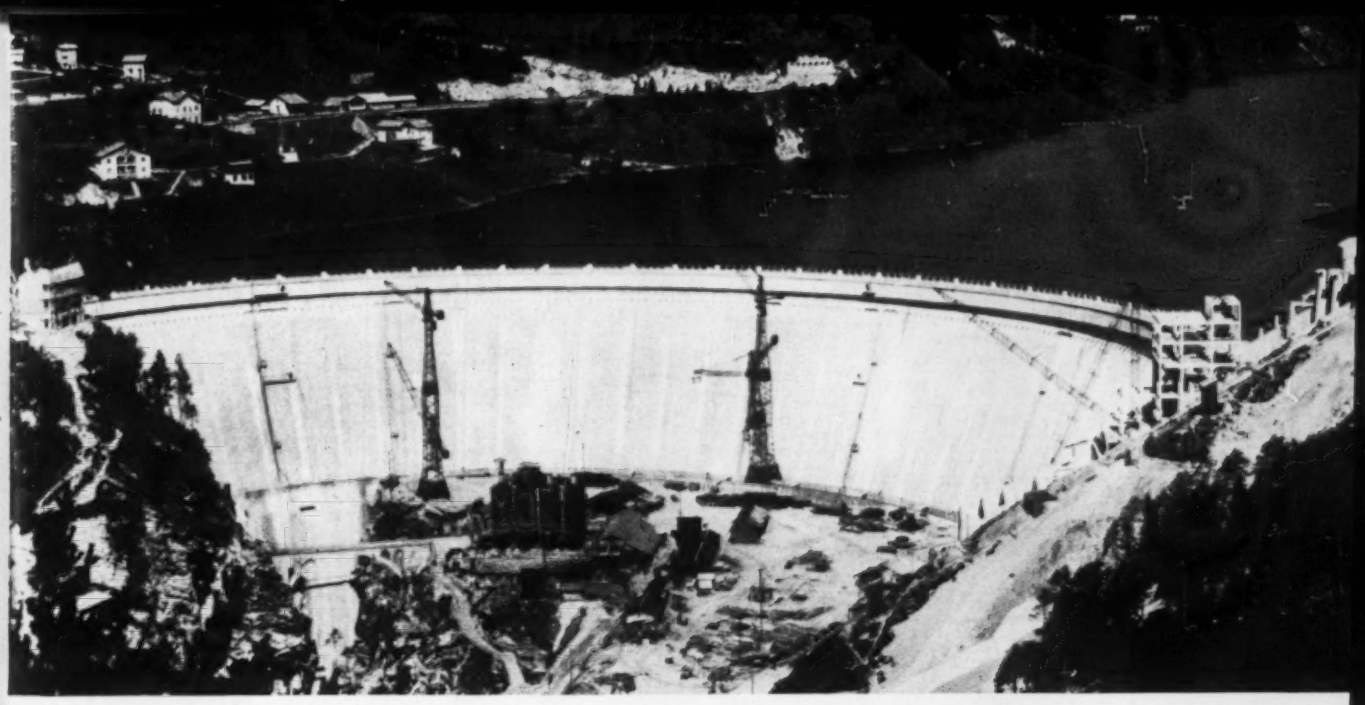
CLUTCHES



Italy Dam of Pieve di Cadore, Province of Belluno **1946-1948**

Arch gravity dam Max. height: 112 meters Length of crest: 410 meters Span: 308 meters

Concrete—494,000 cubic yards. A ferro-pozzolanic cement was used consisting of 75% portland cement and 25% pozzolana. The core concrete contained 338 pounds of cement per cubic yard. The face concrete on the water side contained 424 pounds of cement per cubic yard. Plastiment was added in the proportion of 1% by weight of cement throughout.

OTHER DAM PROJECTS

Venezuela Dam on River Caroni **1956-1959**

Gravity type dam Height: 30 meters Length: 180 meters

Concrete — 262,000 cubic yards with 4 fluid ounces of Plastiment liquid per bag of cement.

Austria Limberg Dam—Kaprun Project 1948-1951

Arch dam Height: 120 meters Length of crest: 350 meters Breadth of crest: 6 meters Breadth of toe: 40 meters

Concrete — 590,000 cubic yards. Mix contained 440 pounds of cement per cubic yard and 1 pound of Plastiment powder per bag of cement. Twenty-eight day compressive strength averaged 4250 psi.

Italy Dam in Val Gallina **1949-1951**

Arch dam Max. height: 92 meters Length of crest: 228 meters Span: 190 meters

Concrete — Mix contained 280 pounds of cement and 140 pounds of fly ash per cubic yard. Plastiment was used to assure good workability and specified compressive strength.

Austria Dam of Salza **1947-1948**

Arch dam Height: 50 meters Length of crest: 120 meters

Concrete — 36,600 cubic yards. Mix contained 458 pounds of cement per cubic yard and Plastiment. Plastiment was used throughout the later stages of construction to assure reaching specified compressive strengths.

Switzerland Dam of Lucendro, St. Gothard **1943-1947**

Buttress dam Height: 70 meters Length of crest: 270 meters

Concrete — 200,000 cubic yards. Face concrete on water side and crest concrete contained 458 pounds of cement per cubic yard and Plastiment powder 1% by weight of cement.

Switzerland Dam of Sella, St. Gothard 1943-1947

Gravity dam Height: 36 meters Length of crest: 300 meters

Concrete — 98,000 cubic yards. Face concrete on the water side contained 458 pounds of cement per cubic yard and 1% Plastiment powder by weight of cement.

Algeria Dam of Beni-Bahdel **1936-1937**

Multiple arched dam Height: Max. 57 meters Length of crest over arch: 220 meters

Concrete — Mix contained 508 pounds of cement per cubic yard and 1% Plastiment powder by weight of cement. Plastiment was added to improve strength and workability.

Improve Your Concrete Dam Construction with SIKA PRODUCTS

Mass Concrete – Plastiment Concrete Densifier

The improved placeability of low slump lean mixes is particularly noticeable with the addition of Plastiment. Compressive strengths are increased 15 to 25% making possible the most efficient use of portland cement. The initial set is retarded and rate of internal heat development is slowed down considerably.

Face Concrete – Plastiment Concrete Densifier

Density is increased and absorption reduced in the richer mixes for face concrete. The ready compaction of low slump concrete and reduced drying shrinkage result in a surface of superior quality.

Power Plants – Plastiment Concrete Densifier

Plastiment is equally effective in the structural concrete made with smaller aggregate and higher cement content. Reduced shrinkage, increased strength, higher bond to reinforcing, and better surface finish are a few of the many advantages.

Flumes – Igas Joint Sealer

Joints in concrete flumes and powerhouse structures are flexible and watertight when sealed at the exposed surface with Igas, nonmeltable mastic joint sealer.

Tunnels – Quicksetting Sika No. 2, Sika No. 4A, and Sigunit

Leakage, which is usually encountered during tunnel construction, is sealed quickly and economically with the 15 second set of Sika No. 2 mortar or slightly slower set of Sika No. 4A mortar. Sigunit is used to accelerate the set of air placed mortar so that seepage can be sealed and heavy patches built-up without delay.

Sika service and products are available around the world, wherever your project may be.

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Ad 26-21

(Continued from page 146)

Milford, to point south of Frederica, 4.45 mi., Kent Co. Bids Aug. 13. CD 8/20, under LB.

BUILDINGS—LB & CA

Jobco, Inc., 220 East Shore Rd., Little Neck, N. Y., CA **$613,500**, Holbrook Rd. ELEMENTARY SCHOOL, CENTEREACH, N. Y. Bd. Educ., Junior High School, Wood Rd., Centereach, N. Y. CD 7/8, under LB.

Skinner & Cook, Inc., 60 E. 42 St., New York 17, N. Y., CA Est. **$525,000**, BARRACKS and SCHOOL, CORNWALL-ON-HUDSON, N. Y. New York Military Academy, Cornwall-On-Hudson, N. Y. York & Sawyer, 101 Park Ave., New York 17, N. Y., archts.

James Romeo & Assocs., 60 Washington St., Tuckahoe, N. Y., CA **$511,150**, general contract HIGH SCHOOL addn., EASTCHESTER, N. Y. Bd. Educ., Eastchester, N. Y. Bids Aug. 14. CD 7/24.

E. W. Howell Co., 101 Park Ave., New York 17, N. Y., CA **$830,000** Est. $750,000, OFFICE, 112-114 E. 64th St., NEW YORK, N. Y. Asia Society Inc., 18 E. 50th St., New York 22, N. Y. Philip Johnson Assocs., 375 Park Ave., New York 22, N. Y., archts. CD 4/28.

Murdock Constr. Co., 800 Clinton Ave., Newark, N. J., CA **$494,867**, total est. $600,000, general contract, 60 unit HOUSING, Potter's Crossing Section of Twp., EDISON TWP., (Nixon P.O.), N. J., Housing Auth. of Twp. of Edison, 1036 Amboy Ave., Metuchen, N. J., Ricker & Axt, 6115 Hudson Ave., West New York, N. J., archts.

Fred Brotherton, 185 Atlantic St., Hackensack, N. J., LB **$745,629**, general contract Ford JUNIOR HIGH SCHOOL, WOODBRIDGE, N. J., Bd. Educ., Woodbridge, N. J. Emil Schmidlin, 586 Central Ave., East Orange, N. J., archt. CD 1/17/57.

▲ **General State Auth.**, 18th and Herr St., Harrisburg, Pa. cancelled bids to have been opened Aug. 27, State SCHOOL for retarded children **$4,000,000**. EBENSBURG, PA., C. J. Lappley, Riverview Manor, Harrisburg, Pa., archt. A. F. Jones, ch. engr. c/o owner. CD 8/6.

Alger Rau & Assocs., Inc., 17024 Miles Ave., Cleveland, O., LB **$495,771**, total est. $672,000, general contract, men's DORMITORY for Edinboro State Teachers' College, EDINBORO, PA., General State Auth., 18 and Herr Sts., Harrisburg, Pa. Bids Aug. 27. CD 7/30.

▲ **Wallace Engineering & Constr. Co.**, Girard Trust Bldg., Phila., Pa. Owner Builds **$1,000,000**. 7 story PARKING GARAGE, 219 S. Broad St., PHILA., PA. CD 3/7/56.

Carl Gommsen & Son, 6210 Belair Rd., Baltimore 6, Md., LB **$679,673** (4 bidders) brick, concrete, steel, block asphalt tile ELEMENTARY SCHOOL north of Glen Burnie, ANNAPOLIS, MD. Bd. Educ. Anne Arundel Co., Annapolis, Md. Rogers, Taliaferro & Lamb, 411 N. Charles St., Baltimore 1, Md. archts.

Firacci Constr. Co., 2552 Woodbrook Ave., Baltimore 17, Md., LB **$972,000**, stone, concrete, steel block AUDITORIUM and MUSIC ARTS BLDG. for Morgan State College (colored), BALTIMORE, MD. State of Md., Dpt. P. Imprvts., 506 Park Ave., Baltimore 1, Md. Bids Aug. 21. CD 8/12.

Altimont Bros., Inc., 4929 Bethesda Ave., Bethesda, Md. LB **$607,000**, SYNAGOGUE, 16th and Jonquil St., N.W., WASH., D. C. Ohev Sholom Synagogue, 5th and Eye St. N.W., Wash., D. C.

Ernest DiSabatino & Sons, 2601 W. 4th St., Wilmington, Del., CA **$606,736**, addns to Silverside and Edge Moor SCHOOL, WILMINGTON, DEL., Mt. Pleasant Special School Dist., Duncan Rd. and Phila. Pike, Wilmington, Del. CD 8/7.

Alger Rau & Assocs., 17024 Miles Ave., Cleveland, O., LB **$492,578**, total est. $500,000, (4 bidders), general contract, high SCHOOL bldg. addn., for Fort LeBoeuf Joint School Bd., WATERFORD, PA., Pa. State P. School Bldg. Auth., 101 S. 25 St., Harrisburg, Pa. Bids Aug. 26. CD 8/12.

SOUTH

HEAVY CONSTRUCTION—BA

STATE HIGHWAY LETTINGS

BRIDGES

September 19 Tennessee — September 23 Florida

STREETS AND ROADS

September 19 Tennessee — September 23 Florida

Fla., Palatka—BA 9/24—City, City Hall, sewage treatment plant and force mains $600,000. Plans deposit $50. Briley-Wild & Assocs., P. O. Box 3052, Daytona Beach, engrs. CD 4/24.

† **Fla., Tampa**—TRAINING BLDG.—BA 10/7—U. S. Eng., P.O. Box 4970, Jacksonville, Flight Simulator Training Building, MacDill Air Force Base, Serial No. ENG-08-123-59-11, Tampa, Fla.

BUILDINGS—BA

▲ **S. C., Clemson**—ENGINEERING—BA 9/18—Bd. Trustees, Clemson Agricultural College, 4 story chemical engineering bldg. Earle Hall and 2 story lab, totalling 51,900 sq. ft. Plans deposit $100. Lockwood Greene Engineers, Inc., Montgomery Bldg., Spartanburg, engr. CD 5/7.

▲ **Fla., Jacksonville**—CITY HALL—BA 9/24—City Comn., City Hall, 225,000 sq. ft. city hall, Plans deposit $130. Reynolds, Smith & Hills, 227 Park St., archts., (Correction—bid date). CD 8/20.

S. C., Waterboro—SCHOOL—BA 9/30—Colleton County School Dist. 2, Waterboro Junior High School. $350,000. Plans deposit $50. John H. Truluck Jr., Box 19, archt.

BUILDINGS—SLC

Fla., Miami Beach—NURSES RESIDENCES—Mount Sinai Hospital of Greater Miami, 4200 Alton Rd., soon lets contract 3 story 128 x 182 CB-S Nurses residences St. Johns Island, Miami Beach, $700,000. Smith & Korack, 1630 Lenox Ave., archts. N. J. Dignum & Assocs., 260 Palermo Ave., Coral Gables, engrs.

HEAVY CONSTRUCTION—LB & CA

▲ **VIRGINIA**—Commonwealth of Hy., Dpt. Hys., 1221 E. Broad St., Richmond,

Va.—**Bowers Constr. Co.**, Box 1706, Raleigh, N. C., CA **$590,637**, 0.93 mi. 24 ft. x 5½ in. c. conc. and 850 ft. bridge beginning 0.65 mi. E. Nottoway River ending 0.44 mi. W. Nottoway River Ret. 258, State Proj. 0258-087-006-007, Fed. Proj. F-027-1 (3) Southampton Co.;

Va.—**Atlantic Bitulithic Co.**, 1400 Roseneath Rd., Richmond, Va., CA **$577,040**, 0.81 mi. 2 lanes c. conc. State Rte. 1, State Proj. 0001-127-071, Fed. Proj. U-127 (1 (2) City of Richmond;

Va.—**E. V. Williams Co., Inc.**, 1269 E. Princess Anne Rd., Norfolk and **W. H. Scott**, Drawer 418, Franklin, Va., CA **$1,834,013**, 2.44 mi. 2 lane, W. Int. Rte. 17, Rte. 64, State Proj. 0064, 135-070-075-076, Old State Proj. 8294-70-75-76, Fed. Proj. I-122-1 (8) City of Newport News;

Va.—**Albert Bros. Contractors, Inc.**, Box 208, Salem, Va., CA **$1,487,919**, 2.54 mi. grading, draining, service road W. Int. Rte. 99, Rte. 81 State Proj. 0081-077-010 G1, Fed. Proj. I-In-81-1 (22) 95 Pulaski Co. Bids Aug. 20. Grand total $4,489,609. CD 8/25, under LB.

▲ **VIRGINIA**—Commonwealth of Va., Dpt. Hys., 1221 E. Broad St., Richmond,

Va.—**Runions Co. and Talbott Marks Co., Inc.**, Clarksville, Va., CA **$1,132,939**, 8 bridges, Contr. 5. Washington Circumferential Hy. Rte. 413, State Proj. 0413-029-006-B, 28B 29B-30, B-31 B-32, B-34, Fed. Proj. I-213-1(1) Fairfax Co.;

Va.—**Moore Bros. Co. Inc.**, P.O. Box 258, Verona, Va., CA **$665,645**, 3 bridges 2.2 mi. E. Int. Rte. 99 Rte. 4, State Proj. 0081-077-010 B1 B2, B3 Pulaski Co. Bids Aug. 20. CD 8/25, under LB.

▲ **NORTH CAROLINA**—State Hy. Comn., Raleigh, Bids opened 8/26,

N. C.—**Thompson-Arthur Paving Co.**, Box 1197, Greensboro, N. C., LB **$164,129** est. $175,000-$200,000, CABC and BST 11.46 mi. 12 sections county road, 825313 S-255(2) S-1027(1) S-1028(1) S-1029(1) S-1030(1) S-1031(1) S-1032(1) S-1033(1) S-1034(1) S-1035(1) Guilford Co.; LB **$142,053** est. $150,000-$175,000 CABC and BST 9.66 mi. 9 sections of county road, 8.25108 S-994/S-995(1) S-996(1) S-997(1) S-998 (1) Alamance Co.; LB **$100,134**, est. $100,000-$125,000, CABC and BST 7 mi. 5 sections of county road 8.25457 S-1054(1) S-1053(1) S-1056(1) S-1058(1) S-1055(1) Rockingham Co.;

N. C.—**T. A. Loving & Co.**, Box 6355, Raleigh, N. C. LB **$425,223** est. $400,000-$500,000, subgrade rein., CABC S.A. base and b. conc. base and surface and structure widening and resurfacing 16.76 mi. U.S. 64 from Pitt Co. line to Williamston, 8.81555 DF-152(7) Martin Co.;

N. C.—**Blythe Bros. Co.**, Box 989, Charlotte, N. C. LB **$397,911** est. $300,000-$400,000, CABC and BST, 8.41 mi. relocation of N.C. 27 between Troy and Pee Dee River Bridge, 8.85581 DF-80(11) Montgomery Co.;

N. C.—**Graham & Simpson, Inc.**, Cleveland, N. C., LB **$177,999** est. $150,000-$175,000, CABC and BST 10 mi. 5 sections of county road, 8.25357 S-1045(1) S-1046(1) S-1047(1) S-1048(1) Orange Co.;

N. C.—**Barrus Constr. Co.**, Box 395, Kingston, N. C. LB **$205,204**, est. $200,000-$225,000, subgrade reinf., CABC S.A. Base and b. conc. base and surface and structures, widening, resurf. 6.25 mi. U.S. 64 between Edgecomb Co. line and Martin Co. line 8.81871 DF-159(11) DF-152(8) Pitt Co.;

N. C.—**Crowell Constr., Inc.**, Box 3406, Fayetteville, N. C., LB **$74,803** est. $75,000-$100,000, S.A. resurf. 17.51 mi. U.S. 701 from its junction with U.S. 421 near South City Limits of Clinton, southwest to Blades Co. line, B.S. 7.281166, Sampson Co. CD 8/18.

SOUTH CAROLINA—State Hy. Dpt., Hotel Jefferson, Columbia,

J. F. Cleckley & Co., Orangeburg, S. C. CA **$797,085**, wid'n., b. conc. surf. 20.752 mi. US Rte. 321 from North to Denmark. S. C. Dockets Nos. 5.313 and 38.487 FAP Nos. DF-358 (4) & DF-2572 (3) Bamberg and Orangesburg Counties. Bids June 17. CD 6/26, under LB.

C. W. Gallant, Inc., P.O. Box 11053, Charlotte, N. C. LB **$273,125** water treatment plant addns CAMDEM, S. C. City, City Hall, Camden, S. C. Bids Aug. 28. CD 7/29.

▲ **GEORGIA**—State Hy. Dpt., 2 Capitol Sq. S. W., Atlanta,

Wright Contg. Co., Drawer 1580, Columbus, Ga., CA **$1,000,576**, grading, resurf. 3.146 mi. locally known as Butler-Thomaston-Griffin Rd. beginning approx. 1670 ft. south of south city limit of Thomaston and Silvertown to point 470 ft. south of Potato Creek, incl. parallel strs. (Center St. and Church St.) in Thomaston, excepting Courthouse Square Proj. F-006 4 (5) Upson Co. Bids May 23. CD 5/29, under LB.

Nichols Constr. Co., 2864 Airline Hy., Baton Rouge, La., CA **$900,000**, 48 mi. 4 in. line between Bremen and La Grange, GEORGIA. Plantation Pipe Line Co., Atlanta, Ga.

▲ **FLORIDA**—State Road Dpt., Tallahassee, Bids opened 7/29,

Brinson-Allen Constr. Co. & Brinson Constr. Co., Box 2209, Tampa, Fla., CA **$6,295,266** (4 bidders) limerock base with surf. tr. shoulders, limerock base with b. conc. surf. course and binder course 3 concrete slab deck single grade separation bridges, 2 concrete slab deck double bridges, aluminum handrail, drainage structures, concrete sheet piling with anchor beams fencing, 10.044 mi. SR Nos. 40,688 and 687, 4-lane west approach to Mid-Bay bridge and Ulmerton Rd., 9 St. and 4 St., connection, FAI Proj. 1-4-1. CD 8/4, under LB.

▲ **FLORIDA**—State Road Dpt., Tallahassee,

Ewell Engr. & Constr. Co., Box 791, Lakeland, Fla., CA **$1,540,988**, est. $1,700,000 (11 bidders) FAP F-031-1 (6) Job No. 1606-201 and State Proj. 1606-108 SR 35 and 700 (US 98), rock base with Type 1 b. conc. surf. course and binder course 10.324 mi. between ST 60 in Batown and Carey's corner in Lakeland, 8½ in. rock base, b. conc. one 90 ft. concrete dual deck bridge on concrete piling; surface course and binder course, 1 concrete box culvert of bridge length, FAP No. F-031-1(6) Job No. 1606-201 and State Proj. 1606-108, Polk Co. Awarded Aug. 26. CD 4/2, under LB.

† **R. E. Clarson**, 1930 13th Ave., St. Petersburg, Fla., CA **$483,517**, Snark Training Facilities at Patrick Air Force Base, ENG-08-123-58-51, COCOA, FLA. U. S. Eng., Box 4970, Jacksonville, Fla. CD 8/25, under LB.

† **Preskitt Constr. Co.**, P. O. Box 217, Fort Walton Beach, Fla., LB **$130,869** erosion control, ENG-01-076-59-11, EGLIN AIR FORCE BASE, FLA. U. S. Eng., 2301 Grant St., Mobile, Ala. Bids Aug. 28, CD 8/15.

A. P. Hennessey & Sons, Inc., P.O. Box 11777, St. Petersburg, Fla., LB **$270,996** disposal plant and sewer lines, INDIAN ROCKS BEACH, FLA. Town, Town Hall, Indian Rocks Beach, Fla. Bids Aug. 29, CD 8/20.

Richardson Constr. Co., 645 N. W. Ave., Fort Lauderdale, Fla., LB **$270,000** water supply and treatment plant Martin Co., INDIANTOWN, FLA. Indiantown Co., Inc., c/o Rader & Assocs., engrs. and archts., 111 NE 2 Ave., Miami, Fla. Bids Aug. 7, CD 7/30.

† **Harbert Constr. Co.**, 2208 8th Ave., S. Birmingham, Ala., CA **$317,500**, 1 million gal. daily sewage treatment plant (completion Aug. 1959) HUNTSVILLE, ALA. Army Ordnance Missile Command, Redstone Arsenal, Huntsville, Ala. Bids Aug. 19, awarded Aug. 26. CD 8/4.

▲ **MISSISSIPPI**—State Hy. Dpt., T. C. Robbins, dir., Jackson,

Blount Bros. Constr. Co., 79 Commerce, Montgomery, Ala., CA **$1,364,101**, est. $1,700,000, bridges, incl. grade separation structures 0.307 mi. Interstate Hy. 59 between Lamar-Forrest and Forrest-Jones Co. lines, Proj. I-ING 092-1(8) (old) I-ING 55-(7)66 (new) Contr. II, Forrest Co. Bids Aug. 26. CD 8/15.

▲ **MISSISSIPPI**—State Hy. Dpt., T. C. Robbins, dir., Jackson,

Miss.—**W. E. Blain & Sons, Contractors**, Hy. 80W, Jackson, Miss., LB **$244,761**, est. $255,000, grading, drainage, culverts, base, bit. surf. 4.624 mi. Hy. 43 between Pearl River bridge (Meeks Ferry) and Sandhill, F-3 037-4 (2), Rankin Co.

Miss.—**R. G. Brown, Jr.**, Louisville, Miss., CA **$1,190,435**, est. $1,290,000, grading, draining, culverts, box bridge 6.336 mi. Interstate Hy. 59, I-ING 092-1(8) (old) Contr. I; I-ING 59-1(7) (66) (new) Contr. I, Forrest Co.

Miss.—**T. B. Groome, Contractors**, Fayette, Miss., CA **$183,549**, est. $205,000, grading, draining, culverts, bridge 0.582 mi. Hy. 27 between Lehr and Tylertown, Proj. F-054-1(2), Walthall Co.

Miss.—**A. A. Bush**, Contractor, Laurel, Miss., LB **$169,657**, est. $170,000, grading, drainage, culverts, box bridge 5.783 mi. Hy. 63 between Averaw-Leakesville, Proj. DS-0231(5)A, Greene Co.

Miss.—**Reed & Shephard**, Belzoni, Miss., CA **$254,108**. Est. $255,000. grading, draining, culverts 7.674 mi. Hy. 442 between Show and Doddsville. Proj. DS0612 (4), Sunflower Co.;

Miss.—**Alvie Goolsby**, Ripley, Miss., CA **$89,117**, Est. $106,000. grading draining, culverts, grav. surf. course 3.054 mi. Hy. 356 between Hightown and Rienzi. Proj. DS-0946(4)A, Alcorn Co.;

Miss.—**Palmero Contr. Co.**, Amroy, Miss., CA **$79,593**, Est. $75,000. grading, draining, culverts, base, bit. surf. tr., asph. surf. course 0.344 mi. Hy. No. 14 Okolona between Hy. 32 and US Hy. 45-W. Proj. F-048-1 (9), Chickasaw Co.;

Miss.—**John H. Moon & Sons, Ridgeland, Miss., CA $224,881**, Est. $269,000. grading, draining, culverts 7.201 mi. Hy. 469 between Miss. Hy. 20 and Harrisville Proj. DS-0418(3)A, Simpson Co. Bids Aug. 26 Grand total $2,436,101. CD 8/15.

MISSISSIPPI—State Hy. Dpt., T. C. Robbins, dir., Jackson,

Rejected bids Aug. 26, base, bit. surf. grading, draining 2.9 mi. Hy. 488 between Freeny and Free Trade. Proj. DS-052-4(5)A, Leake Co. CD 8/15.

† **Gravier & Harper**, Alexandria, La., LB **$332,356**, est. $369,682, Airmen Service Club, England Air Force Base, ENG-03-050-59-5, ALEXANDRIA, LA. U. S. Eng., Box 867, Little Rock, Ark. Bids Aug. 26. CD 7/28.

BUILDINGS—LB & CA

Banks & Lee, Inc., Tower Building, Wash., D. C. CA **$758,500** (6 bidders) MOTEL, Washington and First Sts., ALEXANDRIA, VA. Northern Virginia Hotel Corp., George Mason Hotel, Alexandria, Va. Joseph Saunders, 3636 King St., Alexandria, Va., archt.

(Continued on page 150)

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(Continued from page 148)

▲ **Hauser Constr. Co.**, 927 15th St. N.W., Wash., D. C. CA **$2,060,602** COUNTY COURTHOUSE, ARLINGTON, VA. Arlington County Courthouse, Arlington, Va. Bids Aug. 14. CD 3/18, under LB.

Triangle Constr. Co., Inc., Laurens Rd., Greenville, S. C., LB **$397,800.** County COURT HOUSE ADDITIONS and ALTERATIONS, GREENVILLE, S. C., Bd. Co. Comrs., Greenville, S. C. Bids Aug. 20. CD 7/28/58.

▲ **Abco Builders**, 90 Roger St. NE, Atlanta, Ga. LB **$1,107,352.** W. F. Dykes High SCHOOL, ATLANTA, GA. City Bd. Educ. City Hall, Atlanta, Ga. Bids Aug. 21. CD 8/7.

Peteet Constr. Co., Decatur, Ga., CA **$500,000.** 40 APARTMENT UNITS, DECATUR, GA., Westchester Apartments, Scott Blvd. Decatur, Ga.

E. O. Smithfield, 700 Antone St. N.W., Atlanta, Ga. LB **$415,960** REHABILITATION FACILITY, ATLANTA, GA. Cerebral Palsy Center, 2025 Peachtree Rd., Atlanta, Ga. Saggus, Williamson, Naught & Spiker, 739 W. Peachtree St., Atlanta, Ga., archts. Bids Aug. 21.

R. C. Stevens Constr. Co., 3030 Rutland Bldg., Orlando, Fla. CA **$800,000** alterations, addns. to COLD STORAGE BLDG. and FEED MILL, FORT PIERCE, FLA. Tree Sweet Fruit Co., Mr. Reed Jensen, mgr., Fort Pierce, Fla. CD 7/31.

▲ **Hercules, Inc.**, 108 W. Forsyth St., Jacksonville, Fla. Separate Contracts, 279 HOUSES, Cedar Hills Unit 6, JACKSONVILLE, FLA., **$2,800,000.**

B & M Constr. Co., Meridian, Miss., CA **$610,117,** general contract 71,000 sq. ft. Magnolia SCHOOL for Negroes, MERIDIAN, MISS. Meridian Municipal Separate School Dist., Meridian, Miss Bids Aug. 19. CD 5/1.

M. T. Reed Constr. Co., Box 1066, Jackson, Miss. CA **$983,333,** general contract Northwest ELEMENTARY SCHOOL and Northwest JUNIOR HIGH SCHOOL, MERIDIAN, MISS. Meridian Municipal Separate School Dist., Meridian, Miss. Bids Aug. 15. CD 5/7.

▲ **Southeastern Constr. Co.**, P. O. Box 1197, Jackson, Miss. LB **$1,141,784,** MUNICIPAL AUDITORIUM, LAFAYETTE, LA. City, City Hall, Lafayette, La. Bids Aug. 19. CD 7/16.

▲ **L. W. Eaton Co.**, P. O. Box 767, Baton Rouge, La., LB **$2,088,000.** (5 bidders), Capitol Ave. HIGH SCHOOL, BATON ROUGE, LA. East Baton Rouge Parish School Bd., 805 St. Louis St., Baton Rouge, La. Bids Aug. 21. CD 8/5.

William W. Grubbs Co., Maryville, Tenn., LB **$745,870.** Beardsley Junior High SCHOOL addn., KNOXVILLE, TENN., City Bd. Educ., Knoxville, Tenn. Bids Aug. 14. CD 8/8.

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HEAVY CONSTRUCTION—BA

Mich., Ypsilanti—BA 9/29—City, 304 North Huron, 45,000 sq. yd. single seal coat various streets.

▲ **O., Cleveland**—AIRPORT TERMINAL—BA 9/25—Dpt. Port Control, City Hall, Zone 14, Lakefront Airport Terminal Proj., incl. temporary taxiway connection, relocation existing quad hangars, terminal bldg. constr. and utility installations. $1,250,000. Plans deposit $75. Outcalt Guenther & Assoc., 13124 Shaker Sq., Zone 20, archts. CD 11/10, under Unclassified.

▲ **O., Cleveland**—PARKING LOT—BA 9/25—City, City Hall, underground parking lot under Mall. $4,000,000-$5,000,000. Plans deposit $100. Extended date. CD 7/24.

▲ **O., Warren**—BA 9/25—City, City Hall, Section A, treatment sewage sys., sewage pumping station, force main and sewage treatment plant. $3,875,000. Plans deposit $60. Havens & Emerson, 640 Leader Bldg., Cleveland, Zone 14, engrs. CD 5/20.

BUILDINGS—BA

Mich., Kalamazoo—RESIDENCE HALL—BA 9/17—State Bd. Educ., Capitol Bldg., Lansing, Residence Hall No. 2, Western Michigan University. Plans deposit $75. Ralph R. Calder, 1212 Kales Bldg., Detroit, Zone 26, archt. CD 4/16/56.

▲ **O., Columbus**—CHEMISTRY ADDN.—BA 9/22—Dpt. P. Wks., 706 State Dpt. Bldg., chemistry bldg. addn., Ohio State University. $1,000,000. Plans deposit $50. Spahn & Barnes, 1950 Lee Rd., Cleveland, Zone 18, archt. CD 5/1.

▲ **O., Akron**—SCHOOLS—BA 9/25—Bd. Educ., 70 N. Broadway, 2 Junior High Schools, one on East Ave., and other on Fairfax Rd. $2,600,000. Plans deposit $100. Tuchman & Canute, United Bldg., 777 W. Market St., archt. CD 8/18.

HEAVY CONSTRUCTION—LB & CA

† **U. S. Eng.**, 600 Jefferson St., Detroit, Mich. Own Forces, **$350,000,** dredging channel maintenance of Maumee River and Maumee Bay to depth of 25 ft., extending 14 miles from Anthony Wayne Bridge into Lake Erie, Toledo, OHIO. CD 8/9/57.

▲ **INDIANA**—State Hy. Comn., State House Annex, Indianapolis, Zone 4, Bids opened 8/26,

Ind.—**Skinner Rental Equipment Inc.**, 6341 W. Minnesota St., Indianapolis, Ind., LB **$148,650,** est. $163,770 (7 bidders), bridges, Contr. 4452, Marion Co.; LB **$103,133,** est. $117,047 (5 bidders), bridges, Contr. 4481, Marion Co.

Ind.—**Hunt Paving Co., Inc.**, 3421 W. Kelly St., Indianapolis, Ind., LB **$251,978,** est. $268,858 (9 bidders) bridges, Contr. 4480, Marion Co.; LB **$192,267,** est. $220,138 (9 bidders), bridges, Contr. 4482, Marion Co.

Ind.—**Robert H. King Contr., Inc.**, Danville, Ind., LB **$1,805,035,** est. $2,051,032 (11 bidders), bridges, Contr. 4441, Tippecanoe Co.

Ind.—**Meshberger Stone Co., Inc.**, Columbus, Ind., LB **$186,212,** est. $207,137 (7 bidders), bridges, Contr. 4502, Bartholomew Co.

Ind.—**Lee Pickle Constr. Co.**, Hillsboro, Ind., LB **$140,261,** est. $150,732 (4 bidders), bridges, Contr. 4532, Vermillion Co.

Ind.—**Traylor Bros., Inc.**, Upper Mount Vernon Rd., Evansville, Ind., LB **$154,809,** est. $169,125 (3 bidders), bridges, Contr. 4533, Fountain Co.

Ind.—**Smith & Johnson, Inc.**, 1799 Kentucky Ave., Indianapolis, Ind., LB **$136,316,** est. $145,718 (6 bidders), bridges, Contr. 4536, Shelby Co.

Ind.—**G. H. Allen**, 427½ Main St., Box 272, Vincennes, Ind., LB **$109,967,** est. $128,193 (3 bidders), bridges, Contr. 4538, Daviess and Pike Counties.

Ind.—**Kahl & Mahon**, 402 N. Main St., Liberty, Ind., LB **$117,111,** est. $133,575 (4 bidders), bridges, Contr. 4541, Tipton and Howard Counties.

Ind.—**L. I. Griffin & Sons, Inc.**, 5002 S. Hanna St., Fort Wayne, Ind., LB **$277,680,** est. $291,586 (3 bidders), bridges, Contr. 4542, Vermillion Co. CD 8/13.

▲ **INDIANA**—State Hy. Comn., State House Annex, Indianapolis, Zone 4, Bids opened 8/26,

Ind.—**Contracting & Materials Co.**, 1235 Dodge St., Evanston, Ill., LB **$3,085,796,** est. $4,100,193 (8 bidders), rein.-conc. pavement, Contr. R-4545 I-05-3 (1); Marion Co. LB **$865,079,** est. $893,851 (3 bidders), rein.-conc. pavement, Contr. R-4508, DF-17 (39), Porter and LaPorte Counties.

Ind.—**A. Metz, Inc.**, 7100 W. 9 Ave., Gary, Ind., LB **$946,159,** est. $992,499 (3 bidders), rein.-conc. pavement bit. resurf., Contr. R-4546, DF-104 (20), Lake, Porter and LaPorte Counties.

Ind.—**Stone City Constr. Co.**, 910 R St., Bedford, Ind., LB **$299,314** (1 bidder), conc. base wid'n. bit. resurf., Contr. R-4547, DF-212 (6), Jefferson Co.

Ind.—**A. L. Dougherty**, 3333 Sheffield St., Hammond, Ind., LB **$1,274,943,** est. $1,315,305 (3 bidders), rein.-conc. pavement, Contr. R-4396, I-03-1 (1), U-398 (12), Clark Co.

Ind.—**Rieth-Riley Constr. Co.**, W. Madison St., Box 477, Goshen, Ind., LB **$936,443,** est. $1,011,641, (3 bidders), rein.-con. pavement, Contr. R-4552, DF-720(21), St. Joseph Co.

Ind.—**The Brewer Co.**, 7455 Dawson, Maderia, Cincinnati, O., LB **$208,104,** est. $253,788, (11 bidders), bit. base and resurf., Contr. RS-4553, DF-9(6), Johnson Co.

Ind.—**Muncie Paving, Inc.**, Midtown Park, Muncie, Ind., LB **$88,647,** est. $123,475, (3 bidders), bit. resurf., Contr. RS-4554, DF-13(33), Henry Co.

Ind.—**McMahan Constr. Co.**, Lucas and Wentzel Sts., Rochester, Ind., LB **$97,484,** est. $110,065, (2

(Continued on page 152)

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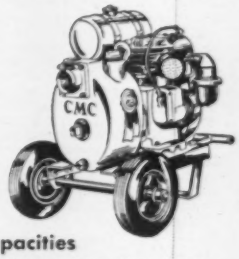

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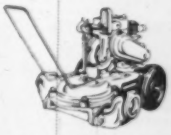

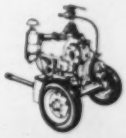

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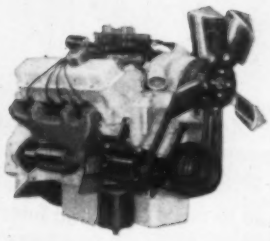

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Take Ford's new Super Heavy Duty V-8's. Built to handle the big jobs easier at less cost, they have new *fully machined* combustion chambers . . . new fuel induction systems . . . new lubrication systems . . . and provide more horsepower per pound of engine weight than ever before possible. These are typical of the many engineering advances you'll find in all Ford Industrial Engines. If you're considering new power or repowering, it'll pay you to check Ford's full line of 4-, 6- and V-8 cylinder engines . . . including the Ford 220-cu. in. and 330-cu. in. Diesels. Most models are available as engine assemblies or power units, foot- or skid-mounted.

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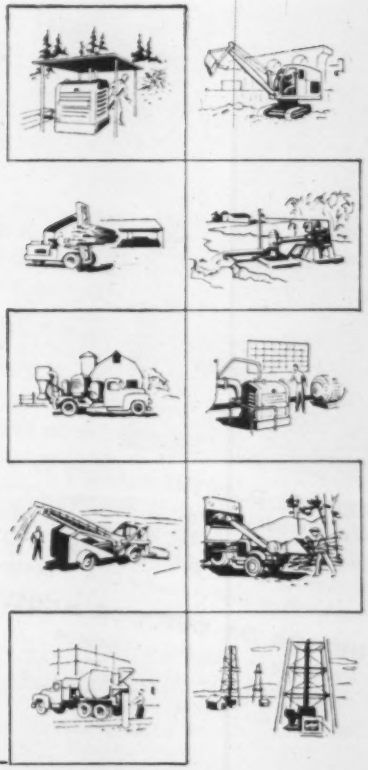

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FORD Division of **FORD MOTOR COMPANY**
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(Continued from page 150)

bidders), bit. base wid'n. resurf., Contr. RS-4555, DF-69(42), Benton and Newton Counties.

Ind.—**Middle West Roads Co.**, 263 W. Eiler Ave., Louisville, Ky., LB **$307,062**, est. $375,843, (11 bidders), conc. base wid'n. resurf., Contr. RS-4557, DF-276(4), Rush and Decatur Counties. CD 8/13.

▲ **ILLINOIS**—Dpt. P. Wks. & Bldgs., Div. Hys., Centennial Bldg., Springfield,

rejected bids Aug. 21, 6.55 mi. resurf., 4.86 mi. widening etc. Ill. 3 and 146 from Junction, Alexander and Union Counties, LB **$616,512**; soil cement course on 2.35 mi. Ill. 92, Henry Co., LB **$99,638**; resurf. 3.66 mi. U.S. 460 from Ill. 163 to Ill. 13, St. Clair Co., LB **$353,994**. CD 8/28, under LB.

▲ **Contracting & Material Co.**, 1235 Dodge Ave., Evanston, Ill., and **Kenny Constr. Co.**, 3220 Oakton St., Skokie, Ill., LB **$3,078,596**, repair and extens. jet runway, bit. paving, removal, prepare base, lay concrete, bit. paving, excav. 365,560 yd., 10 in. concrete overlay over exist. 8,000 ft. asphalt runway, 7,500 sq. yd. bit. paving O'Hare Field, CHICAGO, ILL. Dpt. Purchases, City Hall, Chicago 2, Ill. R. C. Brownell, Chicago, Ill., city engr. Bids Aug. 29. CD 9/19.

▲ **Michael Pontarelli, Inc.**, 4248 N. Kilpatrick St., Chicago, Ill., LB **$1,568,132**, auxiliary outlet sewers, Pratt Ave. sys.; 48 in. rein.-con. pipe and concrete sewers, CHICAGO, ILL. Dpt. Purchases, City of Chicago, City Hall, Chicago 2, Ill. Bids Aug. 28. CD 8/12.

Peter Schumacher & Sons, P.O. Box 375, Mishawaka, Ind., CA **$570,000**, sewage disposal and water supply sys. Turnpike and Rte. 31 SOUTH BEND, IND. South Bend Motor Lodge Inc., National City Bank Bldg., Cleveland, O. Clyde Williams and Assocs., 312 W. Colfax Ave., South Bend, Ind., engrs.

▲ **Superior Concrete Constr. Co.**, 5113 Woodlawn Ave., Chicago, Ill., LB **$1,149,610**, N. W. Expressway, 8 span wide flange beam deck feeder bridge over Chicago River E. approach, Proj. BUGI 265(49) CHICAGO, ILL., County of Cook, Chicago, Ill. Bids Aug. 12. CD 8/4.

L. A. Albergo Constr. Co., 6922 W. Armitage Ave., Chicago, Ill., LB **$263,520**, Congress St. Expressway fixed rail mass transit facilities, base fr. E. of 1st Ave. to W. of DesPlaines, Sec. 062-3334-3a-14d, Forest Park. CHICAGO, ILL. County of Cook, County Hall, Chicago, Ill. Bids Aug. 12. CD 8/4.

Chicago Bridge and Iron Co., 332 S. Michigan Ave., Chicago, Ill., LB **$226,300**, furnish and install 1,500,000 gallon cap. elev. steel water tank, contr. 4 WHEATON, ILL. City of Wheaton, City Hall, Wheaton, Ill. Bids Aug. 18. CD 8/7;

Inland Lake Sewer & Water Co., 657 N. Lake St., Grayslake, Ill., LB **$199,931**, water supply expans., water distribution sys. addn. (Wheaton, Ill.).

Keno Constr. Co., P.O. Box 37, Highland Park, Ill., LB **$86,541**, reinforced concrete reservoir, Contr. 2 (Wheaton, Ill.).

Lloyd S. Thornton Co., Inc., 1675 E. Maple Rd., Birmingham, Mich., CA **$199,199**, Contr. PW 3014A, furnish, install electric motor-driven Pumps 7 and 8; storm water pumping station; piping electrical work, etc. Oakwood Pumping Station, 12330 Sanders, DETROIT, MICH. City, Comr. P. Wks., City-County Bldg., Detroit, Mich. Bids July 1. CD 6/5;

Solomon onstr. Co., 17349 Wyoming, Detroit 21, Mich., CA **$158,723**, Contr. PW-21288 (2), superstructure, Woodmere Pumping Station, West Vernon Hy., (Detroit, Mich.).

BUILDINGS—LB & CA

Friebel & Hartman, 29 Walnut St., Shelby, O. CA **$910,000**, general contract, HOSPITAL, SHELBY, O. Shelby Memorial Hospital, Shelby, O. Conrad & Simpson, Hanna Bldg., Cleveland 15, O., archts. Awarded Aug. 25. CD 8/21, under LB;

C. P. Wright Co., 4300 Carnegie Ave., Cleveland, O., CA **$405,000**, heating and plumbing (Shelby, O.).

▲ **Henning E. Johnson & Sons**, 7649 S. State St., Chicago, Ill., CA **$1,200,000**, 9 APARTMENT BLDGS., paving walks, driveways, swimming pool Sibley Blvd. and Calumet Expressway, CALUMET CITY, ILL. Town and Country Gardens, 7649 S. State St., Chicago, Ill. Fridstein & Fitch, 228 N. LaSalle St., Chicago, Ill., archts.

Joseph Florek (builder), 6352 S. Kenneth Ave., Chicago, Ill. Own Forces, **$500,000**. 20 HOMES, SW side Laramie, Latrobe and Lockwood Sts., CHICAGO, ILL. M. J. McCarthy, 2701 W. 79th St., Chicago, Ill., archt.

Centex Constr. Co., 6 Forest Lane, Elk Grove, Ill., Own forces **$800,000**, ELK GROVE PARK & SHOP CENTER, SE corner Higgins and Arlington Heights Rds., ELK GROVE, ILL.

▲† **Malan Constr. Co.**, 2 Park Ave., New York, N. Y., LB **$3,690,000** (12 bidders) FUEL TECHNOLOGY CENTER, Argonne National Laboratory, LEMONT, ILL. Atomic Energy Comn., Argonne National Laboratory, Bailey and Bluff Aves., Lemont, Ill. Singmaster & Breyer, 420 Lexington Ave., New York 17, N. Y. engrs. Bids Aug. 29. CD 7/24.

Bor-Son Constr. Co., Inc., 1207 South Bend St., Minneapolis, Minn., LB **$389,000**, 1 story part bsmnt. high SCHOOL, NEW RICHMOND, WIS., Bd. Educ., New Richmond, Wis. Bids Aug. 26. CD 7/24.

C. G. Schmidt, Inc., 4199 N. Richards St., Milwaukee, Wis., LB **$490,800**, general contract STUDENT COMMONS AND INDUSTRIAL ARTS BLDG., (SENIOR HIGH SCHOOL), WAUWATOSA, WIS. Bd. Educ., 1732 Wauwatosa Ave., Wauwatosa, Wis. Bids Aug. 26. CD 8/6.

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STATE HIGHWAY LETTINGS

BRIDGES

September 16 Iowa September 19 Minnesota
September 23 South Dakota

STREETS AND ROADS

September 16 Colorado Iowa September 23 South Dakota

Minn., Richfield (P. O. Minneapolis)—BA 9/19—Village, furnish, install 48,000 lin. ft. 9 in. sanitary sewer. $512,000. Orr-Schelen, Inc., 1104 Currie Ave., Minneapolis, engr. CD 8/4.

Mo., Springfield—BA 9/25—City Council Chambers, Springfield Main Trunk sanitary sewers; Div. F-South Creek trunk sewer; Div. L-West Creek trunk sewer; Div. O-East Side trunk and relief sewers. Plans deposit $20. Consoer, Townsend & Assocs., 360 E. Grand Ave., Chicago 11, Ill., consult. engrs. CD 9/28/55.

Mo., St. Louis—MUNICIPAL DOCK—BA 9/30—City, Bd. P. Service, 304 City Hall, 12 Blvd. and Market St., Zone 3, furnishing 38½ mi. steel piling 45 to 71-ft. municipal dock, at foot of North Market St. on Mississippi River. $580,000. Wm. C. E. Becker, 411 N. 7th St., St. Louis 1, Mo., engr. A. L. Munson & Assocs., 4967 Washington Blvd., St. Louis 8, Mo., mechanical engrs. CD 8/15/56.

BUILDINGS—BA

Minn., St. Paul—SCHOOL—BA 9/17—Bd. Educ. Independent School Dist. No. 621, Mounds View, St. Paul, 1 story, 20-classroom Turtle Lake Elementary School, Lexington Ave. and County Rd. No. 1, Mounds View. $550,000. M. & G. Buetow, 1931 University Ave., archts. CD 3/26.

Mo., St. Louis—HEALTH CENTER—BA 9/30—City, Bd. P. Service, 304 City Hall, 12 Blvd. and Market St., Zone 3, brick, concrete, etc. health center, Jefferson and Cass Ave. $635,000. Marcel Boulicault, 411 N. 7th St., St. Louis 1, Mo., archt. Milligan & Miklas, 411 N. 7th St., St. Louis 11, Mo., structural engrs. Toensfelt & Horch, 4658A Gravois Ave., St. Louis 16, Mo., mechanical engrs. CD 5/22/56.

▲ **Tex., Houston**—SCHOOL—BA 10/15—Houston Ind. School Dist., 1300 Capitol St., 3 story, 185,000 sq. ft. Senior High School, Ella Blvd. and 34th St. $2,000,000. Herbert Voelcker & Assocs., 1202 Dennis St., archts.-engrs. CD 8/21.

BUILDINGS—SLC

Tex., Houston—CHURCH—St. Theresa's Catholic Church, 6622 Haskell St., soon lets contract, church, $500,000. Walter P. Moore, 2 Pinedale St., engr., Golemon & Rolfe, 5100 Travis St., archts. CD 10/14.

Tex., Hurst—OFFICE, etc.—Bell Helicopter Corp., soon lets contract 1 story, 45,000 sq. ft. floor space office and cafeteria. $900,000. Don Kirk, 815 N.P. Anderson Bldg., Fort Worth, engr. CD 8/18.

HEAVY CONSTRUCTION—LB & CA

Graus Constr. Co., Hastings, Minn., LB $322,355 (5 bidders) sewage treatment plant, FARMINGTON, MINN. Village, Village Hall, Farmington, Minn. Bids Aug. 26. CD 8/7.

IOWA—State Hy. Comn., Ames,

Central Constr. Co., 108 E. Boston St., Indianola, Iowa, CA **$819,676**, grading 6.997 mi. I-IG-80-2(1)63 (I-IG-01-2(1), Cass Co. Bids Aug. 19. CD 8/26, under LB.

▲ **Ben M. Hogan & Co.**, P. O. Box 2860, Little Rock, Ark., CA **$1,040,000** (combination bid), paving various streets in Dist. 4 and curbing and guttering in Dist. 3, WEST MEMPHIS, ARK. St. Imprvt. Dist. No. 4 and Curb & Gutter Dist. 3, City Hall, West Memphis, Tenn. Bids Aug. 1. CD 8/21, under LB.

Nebraska Constr. Co., Lexington, Neb., LB **$488,824**, est. $510,000 (6 bidders) sewage treatment plant and sewer development, LEXINGTON, NEB. City, City Clerk, S. Y. Gillan, Lexington, Neb. Bids Aug. 19. CD 7/31.

Brown & Brown Constr. Co., 645 E. Crawford St., Salina, Kan., CA **$348,416**, est. $369,281, hot mix asphalt street surf., curbing and gutters in Indian Village section, SALINA, KAN. City City Hall, Salina, Kan. Harold Harper, 5th and Ash Sts., Salina, Kan., engr. Bids Aug. 5.

▲ **TEXAS**—State Hy. Comn., Austin,

Tex.—Collins Constr. Co., P.O. Box 1192, Austin, Tex., CA **$536,393** grade, etc., 29.915 mi. Hy. SH 31, Proj. DF 575 (11) and DF 545 (4) Henderson Co.; CA **$935,746**, grade, etc., 3.049 mi. Hy. IH 30, Proj. I 20-3 (2) 354, Eastland Co.;

Tex.—John G. Holland Constr. & Holland Eng., P.O. 20096, Houston, Tex., CA **$1,486,388**, drainage structures, etc., 0.043 mi. Hy. IH 45, Proj. I 45-1 (15) 50, Harris Co.; CA **$826,778**, grade, etc., 2.496 mi. Hy. SH 146 Proj. U 839 (11), Proj. U 839 (11), Harris Co.;

Tex.—E. B. Darby & Co., P.O. Box 467, Pharr, Tex., CA **$893,209**, grade, etc., 15.603 mi. Hy. US 281, Proj. DS 171 (1), Hidalgo Co.;

Tex.—Cecil Ruby Co. Inc., 910 Brown Bldg., Austin, Tex., CA **$599,352**, grade, etc., 10.841 mi. Hy. FM 689, Proj. S 2075 (4), Medina Co.;

Tex.—**J. O. Boswell,** 311 Paris Ave., Lubbock, Tex., CA **$530,805,** grade, etc., 36.269 mi. Hy. US 180, Proj. DF 1021 (2) and DF 1016 (4) Gaines Co. Grand total $5,808,672. Bids Aug. 19. CD 8/22, under LB.

▲ **Texas**—State Hy. Comn., Austin,

Tex.—**Austin Bridge, Worth Constr. & Crea Bros.,** P. O. Box 1590, Dallas, Tex. CA **$2,029,791** grade, etc. 1.287 mi. Hy. IH 10. Proj. I 10-4 (1) 576 Bexar Co.;

Tex.—**Fred Hall & Son, C. H. Harrison & Dean Skinner,** P. O. Box 488, Valley Mills, Tex. CA **$1,017,480,** wid'n., grade, etc. 15.996 mi. Hy. U. S. 190, Proj. DF 1009 (7) Bell Co.;

Tex.—**Collins Constr. Co. of Texas,** P. O. Box 1192, Austin, Tex. CA **$808,746,** flex base etc. 4.841 mi. Hy. Loop 283. Proj. F 236 (12) Washington Co.;

Tex.—**Henry L. Stafford,** P. O. Box 1047, Lubbock, Tex. CA **$580,806,** reconstr. and wid'n. base, etc. 42.062 mi. Hy. SH 51 & US 62. Proj. DF 1104 (7) & DS 57 (2) & DS 57 (3) Hockley and Terry Counties;

Tex.—**W. O. Pelphrey,** P. O. Box 1157, Fort Worth, Tex. CA **$780,613,** grade, etc. 10.809 mi. Hy. US 183, Proj. S 2147 (1) Stephens Co. Grand total $5,217,436. Bids Aug. 20. CD 8/25, under LB.

Border Constr. Co., Joe Brand Bldg., Laredo, Tex. LB **$517,210.** 168 blocks, asphalt type street paving LAREDO, TEX. City, City Hall, Laredo, Tex. Bids Aug. 26. CD 8/6.

R. B. Butler, Incorp., Box 471, Bryan, Tex. LB **$420,068,** sewage disposal unit, sanitary sewer lines, MARSHALL, TEX. City, City Hall, Marshall, Tex. Bids Aug. 14. CD 8/6.

Yates Constr. Co., P. O. Box 633, Marshall, Tex., LB **$140,648,** sewage disposal unit (Marshall, Tex.).

Coiglazier Constr. Co., Box 11095, Grayson St. Sta., San Antonio, Tex., CA **$147,216,** reconditioning 166 blocks city streets, SAN ANTONIO, TEX. City, City Hall, San Antonio, Tex. V. P. Newman, city engr. CD 10/29.

▲ **MONTANA**—State Hy. Comn., Helena,

Mont.—**Robertson-Cave, Inc.,** 8 Ave. N. W. and River St., Great Falls, Mont. CA **$730,034.** bit. surf. 17.78 mi. Wolf Creek-Augusta Rd. Lewis & Clark Co.;

Mont.—**Francis Tindall,** Lewistown, Mont. CA **$197,133** grade, oil, 2.15 mi. Big Spring-north road, Fergus Co.;

Mont.—**Studer Constr. Co.,** west of Billings, Mont. CA **$261,057** grade 8.7 mi. and constr. 57 ft. timber bridge Shawmut-Hedgesville Rd., Wheatland Co.;

Mont.—**United Constr. Co.,** Bainville, Mont. CA **$126,456.** grade, surf. 5.66 mi. Brandenberg-Garland-Miles City Rd., Custer Co.;

Mont.—**Kiely Constr. Co.,** east of Butte, Mont. CA **$138,701,** oil surf. 10.44 mi. Dillon-Twin Bridges Rd. Beaverhead and Madison Counties;

Mont.—**Long Constr. Co.,** Lockwood Flats, Billings, Mont. CA **$507,106,** grade, surf. 9.7 mi. Gardiner-Livingston Rd., Park Co. Grand total $1,960,487. Bids Aug. 27. CD 8/13.

COLORADO—State Hy. Dpt., 4201 East Arkansas, Denver,

Schmidt Constr. Co., Box 175, Arvada, Colo., CA **$807,849,** est. $814,000, grading, structures and plant mixed asph. surf. 17.682 mi. combined Colo. Proj. No. DF 013-1 (5) and C 19-0102-14, Yuma Co. Bids Aug. 26. CD 8/22/58.

COLORADO—State Hy. Dpt., 4201 East Arkansas, Denver

Pioneer Constr. Co., 29 Lane and Hy. 96, Pueblo, Colo., CA **$230,114,** est. $242,000, structures, grading and asph. surf. 5.233 mi. Colo. Proj. No. DF 025-2 (2), Conejos Co. Bids Aug. 26. CD 8/15.

COLORADO — State Hy. Dpt., 4201 East Arkansas, Denver,

Blanchard Constr. Co., Box 268, Derby, Colo., CA **$387,845,** est. $390,000, grading, structures and plant mixed asph. surf. 7.007 mi. Colo. Proj. No. DF 017-3 (7), Cheyenne Co. Bids Aug. 27. CD 8/22.

COLORADO — State Hy. Dpt., 4201 East Arkansas, Denver,

Gardner Constr. Co., Box 360, Glenwood Springs, Colo., CA **$510,139,** est. $532,000, viaduct over A.T. & S.F., C. & S. and D. & R.G.W. railroads, 0.179 mi. Colo. Proj. No. I-25-1 (18) 99 Pueblo Co. Bids Aug. 27, awarded Aug. 27. CD 8/22.

▲ **NEW MEXICO**—State Hy. Comn., State Hy. Bldg., Cerillos Rd., Santa Fe,

N. M.—**Wylie Bros. Contg. Co.,** P. O. Box 4248, Station A, Albuquerque, N. M., CA **$91,790,** est. $96,277, Lomas Blvd. from Edith to Broadway, Albuquerque, Proj. No. F-003-3(8), Bernalillo Co.; CA **$366,032,** est. $446,177, Mountainair-West, Proj. No. F-027-1(4), Torrance Co.;

N. M.—**Adams Constr. Co., Inc.,** 768 Cerrillos Rd., Santa Fe, N. M., CA **$1,398,674,** est. $1,647,947, Jct. US 66-84, West and Signing Santa Rosa West, Proj. No. I-040-5(2) 250 and I-040-5(4) 258, Guadalupe Co.;

N. M.—**Henry Thygesen & Co.,** P.O. Box 876, Albuquerque, N. M., CA **$138,412,** est. $152,367, Gallup-Shiprock, Proj. FLHP-12(4) and F-031-1(7), McKinley Co.;

N. M.—**Brown Constr. Co.,** 3525 4 St. N.W., Albuquerque, N. M., CA **$723,320,** est. $745,574, Escondido-South, Proj. No. DF-020-1(10), Otero Co.;

N. M.—**Haake Constr. Co., Inc.,** P.O. Box 4188, Coronado Station, Santa Fe, N. M., CA **$365,305,** est. $429,454, Gila Forest Boundary-South, Proj. No. DS-1165(10), Grant Co.;

N. M.—**Joseph C. Hastings,** 937 Isleta Blvd. S.W., Albuquerque, N. M., CA **$160,547,** est. $162,567, Correo Connection to I-40, Proj. No. DS-1335(2), Valencia Co.;

N. M.—**Skousen-Hise Contg. Co.,** 208 Springer Bldg., Albuquerque, N. M., CA **$416,280,** est. $437,530, Mesa Rica-Conchas Dam, Proj. No. DS-1407(2), San Miguel Co. Grand total $5,150,824. Bids Aug. 29. CD 8/19.

BUILDINGS—LB & CA

▲ **O. E. Madsen & Son, Inc.,** 493 Sexton Bldg., Minneapolis, Minn., LB **$1,318,000,** general contract Carl Sandburg JUNIOR HIGH SCHOOL between Douglas Drive and St. Croix Ave., Golden Valley, ROBBINDALE, MINN. Independent School Dist. No. 281, Robbinsdale, Minn. Bids Aug. 27. CD 8/6;
Holm Bros., 20 East Hennepin Ave., Minneapolis, Minn., LB **$375,000,** mechanical work Carl Sandburg Junior High School (Robbinsdale, Minn.).

▲ **M. A. Mortenson Constr. Co.,** Sexton Bldg., Minneapolis, Minn., CA **$1,409,000** (8 bidders), general contract, Capitol View JUNIOR HIGH SCHOOL, County Rd. B2 and Rice St., ROSEVILLE (P. O. St. Paul), MINN. Bd. Educ., Roseville, Minn. Bids Aug. 28. CD 7/30;
C. Harris Plmg. Co., 229 Ohio St., St. Paul, Minn., CA **$373,945** (7 bidders), mechanical work Junior High School (ROSEVILLE, MINN.)

▲ **Hankee Heating Co.,** First National Bank Bldg., St. Paul, Minn., LB **$923,774** (4 bidders), mechanical work 5 story, bsmnt. addn. John Gregory Murray unit to hospital; remodel north wing and main structures, ST. PAUL, MINN. St. Joseph's Hospital, 69 West Exchange St., St. Paul, Minn. Bids Aug. 26. CD 8/25;
Tieso Elec. Co., 1255 Larpenteur Ave. W., St. Paul, Minn., LB **$419,000** (5 bidders), electrical work only John Gregory Murray unit to hospital, etc. (St. Paul, Minn.).

Steenberg Constr. Co., 1371 Marshall Ave., St. Paul, Minn., CA **$640,750,** PARKING RAMP, Sixth and St. Peters Sts., ST. PAUL, MINN. Garrick Parking Ramp, Fourth and Wabasha Sts., St. Paul, Minn. Bids July 23. CD 8/8, under LB.

O. E. Madsen & Son, Inc., Sexton Bldg., Minneapolis, Minn., LB **$778,400** (6 bidders), general contract, 2 story, 4 wings, WORKHOUSE, Upper Afton Rd. to Burns Ave., etc., ST. PAUL, MINN. City and Ramsey County, City and County Workhouse Facility, 1700 Court House, St. Paul, Minn. Bids Aug. 27. CD 7/31.

Spencer Constr. Co., 719 2 Ave. W., Box 590, Spencer, Iowa, LB **$407,000,** municipal LIGHT PLANT addn., Contr. No. 10, SPENCER, IOWA, City, City Hall, Spencer, Iowa, Bids July 17 Stanley Engineering Co., Hershey Bldg., Muscatine, Iowa, engr.

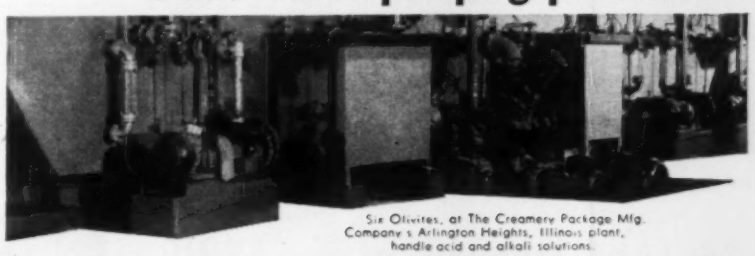
Ben E. Sides, P. O. Box 95, Cape Girardeau, Mo., LB **$348,697** (9 bidders), general contract, base bid, 1 story, brick, metal panels, etc. HIGH SCHOOL, FARMINGTON, MO. Bd. Educ., Farmington School Dist. P-7, Farmington, Mo. Bids Aug. 21. CD 8/13.

Missouri Power & Light Co., 106 W. High St., Jefferson City, Mo., Separate Contracts, **$500,000,** auxiliary propane air GAS PLANT, with connecting pipe line about ¼ mi. west of JEFFERSON CITY, MO. CD 8/14.

▲ **Great Lakes Constr. Co.,** 4325 E. 9th St., Kansas City, Mo., CA Est. **$1,250,000,** 2 story, concrete

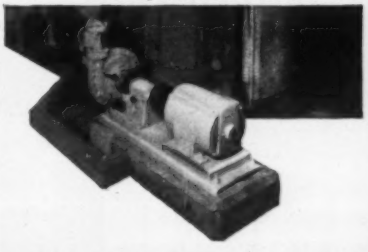
FROM DORR-OLIVER

for tough acid and trade waste pumping problems

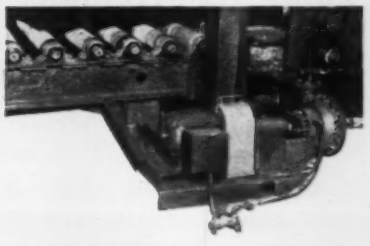


Six Olivites, at The Creamery Package Mfg. Company's Arlington Heights, Illinois plant, handle acid and alkali solutions.

Hydrofluosilicic acid transfer service at Chicago's South District Filtration Plant.



Handling pickle liquor on scrubbing and drying line at Gary Sheet and Tin Mill, this Olivite has given excellent service for over three years.



the HYPALON LINED OLIVITE PUMP

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block, built-up roof MILK PROCESSING PLANT, KANSAS CITY MO. Seal Test Central Div., National Dairy Products Co., 1207 Locust, Kansas City, Mo. Johnson & Johnson, 111 W. Washington, Chicago, Ill., archts.-engrs.

S. Patti Constr. Co., 1340 Admiral, Kansas City, Mo., CA $635,200 Contr. No. 52-B, POWER PLANT UNIT extension for James River Power Station Extension, SPRINGFIELD, MO. City, Utilities, 301 W. Central, Springfield, Mo. Bids Aug. 19. CD 8/12.

▲ Campbell Soup Co., 100 Market St., Camden, N. J. Owner Builds. $1,000,000. expand and modernization to increase production MANUFACTURING FACILITIES, mainly installation of poultry processing equipment (no new bldgs. involved) FAYETTEVILLE, ARK. CD 8/21.

▲ Ebasco Services, Inc., 2 Rector St., New York, N. Y., CA $56,000,000, design and construct 350 000 kw electric POWER PLANT, HELENA, ARK. Arkansas Power & Light Co., 4th and Louisiana Sts., Little Rock, Ark. CD 7/30, under CA.

Warner Constr. Co., Holcombe-Blanton Bldg., San Angelo, Tex., CA $624,721. SCIENCE BLDG., Job No. 200, ALPINE, TEX. Sul Ross State College, Alpine, Tex. Bids Aug. 6. CD 8/14, under LB.

Neill Singleton, Contractor, Box 2130, Amarillo, Tex. LB $420,300. CREAMERY PLANT, AMARILLO, TEX. Borden Co., 609 Grant St., Amarillo, Tex. CD 8/1/56.

H. A. Lott Inc., Box 2505, Houston, Tex., CA $724,925 Base Contract, 3 COLLEGE BLDGS. (music chemistry, shop admin. classroom bldgs.) BEAUMONT, TEX. Lamar State College of Technology Beaumont, Tex. Bids Aug. 21. CD 8/11.

Centennial Constr. Co., Garland, Tex. Owner Builds. $371,000 32 DWELLINGS; $349,175, 28 DWELLINGS in Western Heights Subdivision, GARLAND, TEX. CD 8/29.

▲ George Adams (White Store Chain) Call Field, Wichita Falls, Tex. Owner Builds. $2,000,000. 240,000 sq. ft. masonry SHOPPING CENTER, Denton Hy., HALTOM CITY, TEX. CD 8/19.

Fidelity Development Co., 3625 Fannin, Houston Tex. Owner Builds. $368,950 18 DWELLINGS; $365,000, 22 DWELLINGS, in Windsor Village, HOUSTON, TEX. CD 8/27.

Krebs Constr. Co., Box 1108, Houston, Tex. LB $483,850 Alcott Area ELEMENTARY SCHOOL, HOUSTON, TEX. Houston Ind. School Dist., 1300 Capitol St. Houston, Tex. Bids Aug. 21. CD 8/6.

L. W. Prokop Bldg. Co., 6903 Long Point, Houston Tex. Owner Builds. $378,000. 30 DWELLINGS. $360,000. 24 DWELLINGS, in Windsor Village, HOUSTON, TEX. CD 8/27.

Schneider Constr. Co., Box 13157, Houston, Tex., CA Est. $780,000, WAREHOUSE UNIT NO. 1, HOUSTON, TEX., Houston Belt & Terminal Railway Co., Union Station, Houston, Tex., Grand Total $980,116. CD 8/28;

B & H Constr. Co., 2415 Cullen, Fort Worth, Texas. LB $312,800, WAREHOUSE and OFFICES on Seminary Dr., FORT WORTH, TEX. Worth Food Mart, 1101 W. Vickery, Fort Worth, Tex. Mesmith, Lane & Kuykendall. 939 Sandhills Dr., El Paso, Tex., archts.

▲ Candoo Constr. Co., Box 14226, Houston 21, Tex. CA $1,189,000. 2nd unit HIGH SCHOOL, South Houston PASADENA, TEX. Pasadena Ind. School Dist., Pasadena Tex. Bids Aug. 20. CD 7/23.

Centennial Constr. Co., Garland, Tex. Owner Builds. $368,115 30 DWELLINGS, RICHARDSON, TEX. CD 8/29.

FAR WEST

HEAVY CONSTRUCTION—BA

STATE HIGHWAY LETTINGS

BRIDGES
September 30 California

STREETS AND ROADS
September 18 Nevada

† California—BA 9/23—U. S. Eng., 1209 8th St., Sacramento, levee constr. right bank Sacramento River, Sidds Landing to Ord Bend Mile 177.5 to Mile 184.7, incl. 480,000 cu. yd. levee embankment, 36,450 tons cobbles above low water and 46,110 tons cobbles below low water, Spec. No. 2457 CIVENG-04-167-59-4. $800,000. CD 10/13/55.

▲ CALIFORNIA—BA 9/30—State Div. San Francisco-Oakland Bay Toll Crossings, 151 Fremont St., San Francisco,

San Francisco Co.—constr. Sterling Street Ramps in connection with San Francisco-Oakland Bay Bridge reconstr. proj., incl. Perry and 1st St. ramps, lowering of present Beale St. "On ramp" and bldg. roadway from Sterling St. to San Francisco anchorage. $1,500,000. CD 3/18.

BUILDINGS—BA

▲ Calif., Norwalk—WARD—BA 10/1—State Div. Architecture, 1100 S. Grand Ave., Los Angeles, 1 story, about 56,000 sq. ft. floor area ward bldg., incl. dormitory wing units, separate exercise yards and hard facilities, at Metropolitan State Hospital, W. O. 3718GC-26. $1,350,000. Plans deposit $75. CD 1/10.

HEAVY CONSTRUCTION—LB & CA

▲† Lewis Hopkins Co. & Arthur Sime, Pasco, Wash., CA $1,093,945, enlargement Little Wood River Dam, Little Wood River Proj., Spec. DC 5042, IDAHO, Bureau Reclamation, Dpt. Interior, Rupert, Idaho. Bids July 10, awarded Aug. 22. CD 7/17, under LB.

▲ UTAH—State Rd. Comn., State Capitol, Salt Lake City, Bids opened 8/26,

Utah—Thorn Constr. Co., Box 111, Springville, Utah, LB $475,342, plant mix bit. surf. 9.031 mi. and concrete structural 26.33 ft. State Rd. 28 FAP DF-022-1(1), Juab and Sanpete Counties; LB $234,828, 2-in. road mix bit. surf. 9.296 mi. State Rd. 148 FAS Proj. S-0273(1), Juab Co.;

Utah—W. W. Clyde, Box 231, Springville, Utah, LB $596,773, 4-in. plant mix bit. surf. 8.654 mi. US 40 from Ft. Duchesne, 1 concrete structure 24,82 ft. long. FAP DF-015-3(1), Uintah Co.;

Utah—Fife Constr. Co., Brigham City, Utah, LB $366,269, 4-in. plant mix bit. surf. 4.711 mi. State Rd. 123. FAP No. DF-028-2(2) 1st contract, Carbon Co.

▲ NEVADA—State Hy. Dpt., State Hy. Bldg., Carson City,

Dodge Constr. Inc., Fallon, Nev. CA $1,173,683 (7 bidders) constr. State Hy. Sys. 15.466 mi. US Hy. 93 between 30 mi. north of Wells and 2 mi. north of Contact, Rte. Section 007-5 Control sections EL-16 & EL-17 Proj. DF-DFG-007-5 (4), State Hy. Contr. No. 1040. Bids Aug. 28, awarded Aug. 29. CD 8/21.

† WASHINGTON—Bureau P. Rds., Dpt. Commerce, Morgan Bldg., Portland, Ore.,

Osberg Constr. Co., 1132 N. 128 St., Seattle, Wash., CA $442,330, est. $430,029 (4 bidders), grading, surf., constr. of 60 ft. and 90 ft. precast concrete and timber bridge on 4.5 mi. South Fork Stillaguamish Hy. from Perry Creek to Barlow Pass, Proj. 7-J, Snohomish Co. Bids Aug. 29. CD 8/20.

† George W. Lewis & Thompson Constr. Co., Ephrata, Wash., CA $693,119, constr. earthwork, structures for Potholes East canal enlargement, Sta. 172 plus 00 to 251 plus 00 and 510 plus 00 to 770 plus 00, Schedules 2 and 5, Columbia Basin Proj., DC-5068, WASHINGTON, Bureau Reclamation, Dpt. Interior, Ephrata, Wash. Bids Aug. 5. CD 8/13, under LB.

† Meyers & Major, Box 146, Vancouver, Wash., LB $515,955 (5 bidders) 27 units of family housing at Naselle Air Force Station, Inv. 59-2, NASELLE, WASH. Procurement Office, McChord Air Force Base, Wash. Bids Aug. 29. CD 7/17.

▲† Keystone Constr. & Assocs., Prineville, Ore., LB $2,614,944, Prineville Dam, Crooked River Proj., Spec. DC 5047 OREGON, Bureau Reclamation, Dpt. Interior, Bldg. 1A, Denver Federal Center, Denver, Colo. Bids Aug. 26. CD 8/12.

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▲ **CALIFORNIA**—State Div. Hys., 120 S. Spring St., Los Angeles, Bids opened Aug. 28,
Calif.—**Ukropina, Polich & Kral**, P. O. Box 105, San Gabriel, Calif. LB **$2,445,261** (9 bidders) grade, pave 2.7 mi. Riverside Freeway, Sign Rte. 14. 6 lanes between 0.2 mi. west Spradro Rd. and 0.1 mi. east of Placentia Ave. in Anaheim, Fullerton, vicinity, incl. bridges and access facilities, Orange Co.;
Calif.—**Daley Corp.**, Mission Valley at Ward Rd., San Diego, Calif. LB **$1,956,609** (7 bidders) grade, pave 2 mi. 8 lane freeway State Sign Rte. 94 between 24th St. and Home Ave. in San Diego, incl. 265 ft. bridge to take 25th St. traffic over freeway; San Diego Co. CD 7/30.

▲ **CALIFORNIA**—State Div. Hys., 120 S. Spring St., Los Angeles.
Oberg Constr. Corp. & Oberg Bros. Constr. Co., 19424 Plummer St., Northridge, Calif. CA **$5,226,495** constr. 3.9 mi. 8 lane freeway and 15 structures U. S. Hy. 101 between Encino and Kelvin Aves. in Los Angeles, Los Angeles Co. Bids Aug. 14, awarded Aug. 27. CD 8/19, under LB.

CALIFORNIA—State Div. Hys., 120 S. Spring St., Los Angeles,
Sully-Miller Contg. Co., 1500 W. 7th St., Long Beach, Calif. LB **$614,389** (5 bidders) grade, surf. 3.3 mi. to widen Lincoln Ave. in and near Anaheim, U. S. Hy. 9, State Sign Rte. 18 to 4 lane divided hy. between Stanton Ave. and Santa Ana Freeway. VII-Ora-178. A, Ana, Orange Co. CD 7/31.

▲ **Fredrickson & Watson Constr. Co. & Ransome Co.**, 873 81st St., Oakland, Calif. LB **$1,047,907** (3 bidders) base rock, drainage and electrical ducts for paved area at Metropolitan Oakland International Airport, OAKLAND, CALIF. Port of Oakland, c/o Secy., Room 73, Grove St. Pier, Oakland, Calif. Bids Aug. 25. CD 8/18.
Ben C. Gerwick, Inc., 417 Market St., San Francisco, Calif. LB **$113,477** (3 bidders) drainage pump houses (Oakland, Calif.).

▲ **Stolte, Inc.**, 8451 San Leandro St., Oakland, Calif. LB **$1,082,964** (11 bidders) road grade separation, drain pipe, manholes, curbs, gutter, etc. road imprvs., Page Mill Rd. and Oregon Ave., Proj. No. 57-5, PALO ALTO, CALIF. City, City Hall, Palo Alto, Calif.

BUILDINGS—LB & CA

▲ **John H. Sellen Constr. Co.**, 228 9 Ave., N., Seattle, Wash., LB **$1,073,000**, (4 bidders), offices in MISSILE PRODUCTION CENTER, SEATTLE, WASH., Boeing Airplane Co., 7755 E. Marginal Way, Seattle 4, Wash.

Carvers Constr. Co., 2101 E. Weber Ave., Stockton, Calif., LB **$427,540** (9 bidders) new wing at Amador County HOSPITAL, JACKSON, CALIF., Supervs. Amador Co., Courthouse, Jackson, Calif. Bids Aug. 26, CD 8/21.

▲ **Diversified Builders, Inc.**, P. O. Box 877, Paramount, Calif., LB **$4,790,000** (6 bidders), general contract, 9 story, bsmnt., 542,000 sq. ft. OFFICE No. 2 and 7 story GARAGE, bsmnt. and sub-bsmnt., for Dpt. of Finance, W. O. 3848GC-3 and W. O. 4001GC-7, LOS ANGELES, CALIF. State Div. Architecture, 1100 S. Grand Ave., Los Angeles, Calif. Bids Aug. 27. CD 7/18.
Scott Co., 6824 Vineland Ave., North Hollywood, Calif., LB **$1,846,300** (10 bidders), combined mechanical work for Office Bldg., (Los Angeles, Calif.).

Charles A. Langlais Co., 180 Glendale Blvd., Los Angeles, Calif. LB **$480,000** (12 bidders) electrical work for 9 story, bsmnt. OFFICE for State Dpt. Finance, LOS ANGELES, CALIF. State Div. Architecture, 1100 S. Grand Ave., Los Angeles, Calif. Bids Aug. 27. CD 7/18;
Otis Elevator Co., 2417 Beverly Blvd., Los Angeles, Calif. LB **$459,848** (2 bidders) elevator work (Los Angeles, Calif.).

Los Angeles Co., 108 W. 2nd St., Los Angeles, Calif. rejected bids opened June 18, HEALTH BLDG. and SAFETY BLDG., Spec. 1806, Whittier, LOS ANGELES, CALIF. LB **$562,162**. Will re-advertise. CD 6/25, under LB.

▲ **Stolte, Inc., and M&K Corp.**, 8451 San Leandro St., Oakland, Calif. CA **$1,388,900** general constr. 8 story OFFICE BLDG. for State Dpt. Finance, OAKLAND, CALIF. State Div. Architecture, 1120 N. St., Sacramento, Calif. Bids Aug. 12, awarded Aug. 28. CD 8/14, under LB.
E. C. Braun Co., 2115 4th St., Berkeley, Calif. CA **$555,890** combined mechanical work (Oakland, Calif.) CD 8/18, under LB.

▲ **Henderson Constr. Co.**, 33 Ritch St., San Francisco, Calif. LB **$1,169,000** (7 bidders) frame, stucco Sobrante Park JUNIOR HIGH SCHOOL, OAKLAND, CALIF. City Unif. School Dist., c/o Supt., 1025 2nd Ave., Oakland, Calif. Bids Aug. 26. CD 7/29.

▲ **Means & Ulrich**, 1218 S. Main St., Santa Ana, Calif. CA **$2,346,000**. 168,159 sq. ft. frame, stucco Del Rio SENIOR HIGH SCHOOL, SANTA ANA, CALIF. School Dist., 1415 French St., Santa Ana, Calif. Bids Aug. 19. CD 7/29.

CANADA

STATE HIGHWAY LETTINGS
BRIDGES
September 16 Ontario

HEAVY CONSTRUCTION—LB & CA

Assiniboia Constr. Co., Ltd., P. O. Box 398, Calgary, Alta., LB **$736,765**, 1,200 ft. tunnel to divert Waterloo River, WATERTON, ALTA. CD 12/3/43, under Alberta.

▲ **BRITISH COLUMBIA**—Dpt. P. Wks., Hunter Bldg., Ottawa, Ont., bids opened Aug. 21.
Dawson Wade & Co., Ltd., 775 Clark St., Vancouver, B. C., LB **$1,467,136**, grading, culverts and bridge constr. mile 12.4 to mile 18.7 Trans-Canada Hy., Glacier National Park, Glacier Co. CD 7/25.

▲ **BRITISH COLUMBIA**—Dpt. Pub. Wks., Hunter Bldg. Ottawa, Ont. bids opened Aug. 21.
New West Constr. Co., Ltd., 10480 113 St., Edmonton, Alta., LB **$2,876,015**, grading and culverts, sub-base and base constr., mile 0 to mile 5.0, Emerald Lake Rd., Yoho National Park, Field Co. Bids Aug. 8. CD 8/5.
Connolly & Twizell Ltd., 2655 Bates Rd., Montreal, Que., CA **$639,671** (3 bidders) underground steam distribution sys. hmcs Cornwallis, Canadian Naval Base DEEP BROOK, N. S. Defence Construction (1951) Ltd. 56 Lyon St., Ottawa, Ont. Awarded Aug. 22. CD 8/7, under LB.
▲ **Schwenger Constr. Ltd.**, 1255 Beach Rd., Hamilton, Ont. CA **$1,174,134** 8 m.g.d. water filtration plant near UNION, ONT. Ontario Water Resources Comm., Rm. 5504, East Block, Parliament Bldgs., Toronto, Ont. Bids Aug. 25, awarded Aug. 26. CD 7/24.
J. A. Auclair, 105 Royale St., Gifford, Que., CA **$300,000**, sewers and waterworks CHARLESBOURG, QUE. Ville de Charlesbourg, Town Hall, Charlesbourg, Que. Awarded Aug. 21.
▲ **A. Janin Co. Ltd.**, 1460 Sherbrooke St. W. Montreal, Que. LB **$1,108,700**, sixth section of Decarie-Raimbault collector sewer, trunk sewer in Westbury Ave. and branch sewer in Atholl Place, MONTREAL, QUE. City of Montreal, City Hall, Montreal, Que. Bids Aug. 27. CD 8/22.
Spino Constr. Ltd., 222 Sauve St. W., Montreal, Que., LB **$234,737**, part of sixth section of Decarie-Raimbault collector sewer, branch sewer Victoria and Vezina Sts., (Montreal, Que.);
G. M. Gest Ltd., 128 Elmslie St., Montreal, Que., LB **$234,146**, contruction underground conduits, manholes, etc. in area bounded by Notre Dame and Vimont Sts., in connection with Decarie-Raimbault Collector Sewer (Montreal, Que.).

BUILDINGS—LB & CA

▲ **Commonwealth Constr. Co.**, 300 Royal Bank Bldg., Winnipeg, Man., CA Est. **$5,000,000**, MANUFACTURING BLDG., OFFICE and SERVICE BLDG. and boiler plant, using natural gas, plant 1 story, 300 x 400 ft. PORTAGE LA PRAIRIE, MAN. Campbell Soup Co. Ltd., 60 Bermingham Rd., New Toronto, Ont. Bids Aug. 13, awarded Aug. 26. CD 7/25.
▲ **M. Sullivan & Son Ltd.**, 234 Elgin St., Arnprior, Ont., CA **$1,534,674** (12 bidders) 3 story wing addn. and 6 story wing hospital and enlargement of nurses

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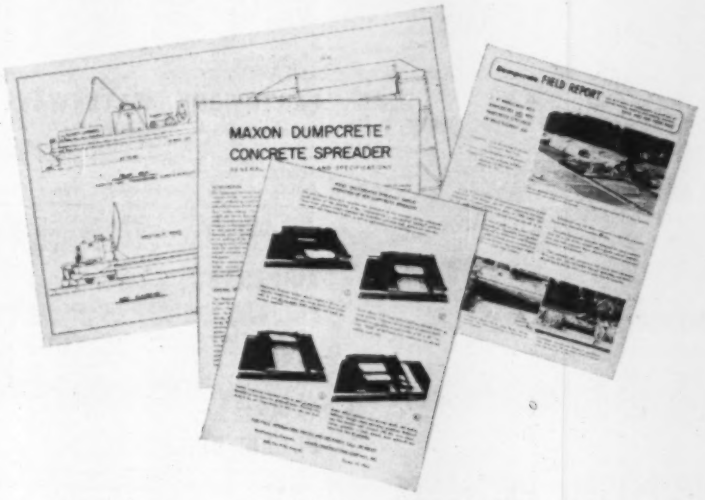

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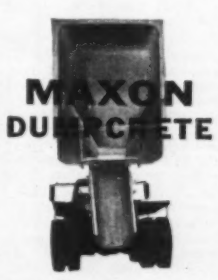

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residence, BROCKVILLE, ONT. Brockville General Hospital Bd. Governors, Brockville, Ont. Bids Aug. 14. Awarded Aug. 20. CD 7/24.

▲ **Hill-Clark-Francis Ltd.**, 4781 Van Horne Ave., Montreal, Ont., CA $1,100,000, 3 story, wings each 45 x 165 ft., structural steel frame, masonry walls, precast concrete roof U-shaped HEALTH PHYSICS AND BIOLOGY BLDG., CHALK RIVER, ONT. Atomic Energy of Canada, Ltd., Chalk River, Ont. Awarded Aug. 22. CD 8/11, under LB.

▲ **Ellis-Don Ltd.**, Box 852, London, Ont., CA $1,133,879 WAREHOUSE and UTILITIES, Canadian Army Camp, LONDON, ONT. Defense Construction (1951) Ltd., 56 Lyon St., Ottawa, Ont. Awarded Aug. 25. CD 8/14, under LB.

▲ **Dell Constr. Co. Ltd.**, 2461 Bloor St. W., Toronto, Ont., CA Est. $3,000,000 (15 bidders), 10 story, structural steel, brick wall, prefab. concrete floors, OFFICE rein.-con. fdn., air conditioned, Yonge St., TORONTO, ONT. Dpt. P. Wks., Parliament Bldgs., Toronto, Ont. Bids July 16. CD 6/24.

▲ **Milne & Nicholls Ltd.**, 57 Bloor St. W., Toronto, Ont. CA Est. $1,250,000 (8 bidders) 3 story, bsmnt. 112 x 140 ft. TEMPLE addn., structural steel frame, poured concrete foundation, rein.-con. walls, acoustic tile ceilings, TORONTO, ONT. Holy Blossom Temple, 1950 Bathurst St., Toronto, Ont. Bids July 29, awarded Aug. 25. CD 7/21.

P. W. Graham & Sons, 701 Ominica St. W., Moose Jaw, Sask, CA $958,440, COLLEGIATE MOOSE JAW, SASK. Moose Jaw School Bd., Moose Jaw, Sask. Bids Aug. 11. CD 1/13.

Louis Fecteau Inc., 236 Commissaires St., Quebec City, Que., CA $704,675, stone, wood windows, cathedral glass etc. CATHEDRAL, Blvd. Joliet HAUTERIVE, QUE. LaFabrique de la Paroisse de St. Eugene c/o Parent-Moranville, P. O. Box 309, Hauterive, Que., archt. Awarded Aug. 21. CD 8/18, under LB.

▲ **Cite Construction Cie. Ltee.**, 175 Beaubien St. E., Montreal, Que., CA $1,225,150 (11 bidders) HIGH SCHOOL, Cote St. Luc Rd., MONTREAL, QUE. Montreal Catholic School Comn., 3737 Sherbrooke St. E., Montreal, Que. Dufresne & Boulva, 1275 Hodge St., St. Laurent, Que., archts. Bids June 17, awarded Aug. 19. CD 6/26 under LB.

ALASKA

HEAVY CONSTRUCTION—SLC

▲† **Alaska**—Chugach Electric Assn., Anchorage, soon lets contract, constr. 5,000 ft. tunnel, intake structures and access road for Cooper Lake Hydro Proj. North Pacific Consultants, 220 S. W. Alder St., Portland, Ore., engrs. CD 5/28.

AMERICANS ABROAD

BUILDINGS—LB & CA

▲ **Foster Wheeler Ltd.**, c/o Foster Wheeler Corp., 666 5th Ave., New York 19, N. Y., U. S. A., CA Est. $35,000,000. REFINERY, at Milford Haven, WALES Esso Petroleum Ltd., affiliate of Standard Oil (N. J.) 30 Rockefeller Plaza, New York, N. Y., U. S. A.

PROPOSED PROJECTS

WATER SUPPLY

Ala., Anniston—Water Bd., City Hall, water facilities extensions and imprvs to outlying communities of Saks, Golden Springs, Hollingsworth and West Anniston, $750,000 Polglaza & Basenberg, 812 S. 27th St., B'Ham St., consult. engrs.

▲ **N. C., Burlington**—City, City Hall, bond election Sept. 16, 2.8 billion gallons Storage Lake, water supply, $1,275,000. William C. Olsen & Assoc., 5 Exchange Pl., Raleigh, engrs.

O., Georgetown—City, City Hall, water mains, treatment plant, reservoir, $250,000. Al. LeFeber, 2933 Woodburn Ave., Cincinnati, consult. engr. Constr. 1959.

S. C. Sumter—City, City Hall, water treatment plant addns. lines, $600,000. CD 7/2/52.

SEWERS, WASTE DISPOSAL

▲ **Calif., Hayward**—City, City Hall, $3,325,000 bond election Oct. 7, sanitary sewer sys. imprvs., incl. constr. 12 MGD secondary treatment plant and expan. present 5 MGD plant to 12 MGD.

Colo., Littleton—City, City Hall, sewer treatment plant expansion $800,000 Dale Rea, 2200 W. Chenango Ave., consult. engr. CD 7/10/57.

Fla., Riviera Beach—Mission Development Co., 31 W. 20th St., sewage treatment plant and collection sys. Over $850,000. Brockway, Weber & Brockway, Guarantee Bldg., West Palm Beach, consult. engrs.

Ga., Decatur—Bd. Comre. DeKalb Co. secondary sewage treatment plant. Over $960,000 Robert & Co. Assocs., 96 Poplar St., N. W. Atlanta, consult. engrs., CD 8/8/57.

▲ **Mo., St. Louis County**—Metropolitan-St. Louis Sewer Dist., 901 Washington Ave., St. Louis, Zone 1, election Oct. 14, $4,100,000 bonds, 12⅓ mi. sanitary trunk sewers, Gravois Creek Sanitary Sub-Dist. in Gravois Creek Watershed, southern part of St. Louis County Sverdrup & Parcel, Inc., 917 Olive St., St. Louis 1, Mo., consult. engr. CD 5/16/56.

Mo., Ellisville—City, City Hall, voted $560,000 bonds and $65,000 general obligation in revenue bonds Aug. 19, sanitary sewer sys., $689,000. CD 8/4.

S. C. Easley—City, City Hall, secondary sewage treatment plant, outfall sewers, etc. $500,000 Bid target Oct. 1958. Harwood Beebe Co., P. O. Box 2405 consults. engr.

S. C. Sumter—City, City Hall, sewage disposal plant addns. etc., $600,000; storm sewer addns. $150,000.

▲ **Tex., Abilene**—City, City Hall, voted $1,000,000 bonds Aug. 19, sewer extens., CD 8/5/57.

BRIDGES

ARKANSAS and TEXAS—Arkansas State Hy. Comn., State Capitol, Little Rock,
Little River Co.—1,261 ft. 28 ft. wide bridge across Red River Arkansas Hy. 41 to Texas Hy. 8, Foreman. $720,000. CD 12/24/43.

▲ **Alta., Calgary**—City, City Hall, 6 span 49 ft. concrete bridge, poured concrete foundation, 4 lane overpass, two-pronged cloverleaf and 6,300 ft. roadway, known as Alyth Bridge proj., $1,500,000. Structural Engineering Services Ltd., Calgary, consult. engr.

STREETS AND ROADS

▲ **Calif., Hayward**—City, City Hall, $4,745,000 bond election Oct. 7, street imprvs. CD 7/16.

▲ **IOWA**—State Hy. Comn., Ames,
Polk Co.—13.5 mi. 4-8 lane freeway thru Des Moines and West Des Moines, $55,000,000. To go ahead in 1959, Howard, Needles, Tammen & Bergendoff, 1805 Grand St., Kansas City, Mo., consult. engrs.

▲ **N. J., Newark**—Bd. Freeholders, Essex Co., wid'n. 4½ mi. Park Ave. from Bloomfield Ave., Newark to West Orange, $3,000,000. Curtis C. Colwell, Hall of Records, city engr.

▲ **Tex., Abilene**—City, City Hall, voted $2,250,000 bonds Aug. 19, street imprvs. and railroad underpass. CD 8/5/57.

EARTHWORK, WATERWAYS

▲ **Massachusetts**—Commonwealth of Mass., Metropolitan Dist., Comn., Constr. Div., 20 Somerset St., Boston, flood control Furnace Brook and Black's Creek. $4,000,000. Constr. 1958.

▲ **Ontario**—Ontario Hydro-Electric Power Comn., 620 University Ave., extra high voltage transmission proj., first stage of one mile test line to be used in two-year study of transmission and electricity within range of 260,000 to 600,000 volts, Coldwater, $1,000,000.

AIRPORTS

▲† **Fla., Pine Castle**—HOUSING—Air Force Contracting Office, Pine Castle, Fla., plans by Joseph H. Brywon, 111 W. Adams St., Jacksonville, 688 Capehart Housing Units, McCoy Air Force Base, $11,000,000. CD 1/31/51.

Sask., Regina—AIR TERMINAL—Dpt. Transport, Ottawa, Ont., 4 story, 240 ft. steel frame air terminal bldg., $850,000. Bids in Sept. CD 11/3/55.

PUBLIC BUILDINGS

Ala., Huntsville—CLASSROOMS—University of Alabama, Campus, Tuscaloosa, classrooms building, $750,000.

▲ **Calif., Hayward**—CIVIC CENTER BUILDINGS—City, City Hall. $3,700,000. Bond Election Oct. 7 Civic Center bldgs.

▲ **Calif., Santa Ana**—COUNTY BLDGS.—Bd. Supervs. Orange Co., Court House, Santa Ana, $13,000,000 bond election Nov. 4, county bldgs. in Civic Center. CD 11/23/56.

▲ **Conn., Milford**—SCHOOL—Town, Bd. Educ. 38 W. River St. plans by Schilling & Goldbecker, 18 Trumbull St., New Haven West High School Devon Park, $1,400,000 Frederick P. Clark Assocs., 41 Theodore Frend Ave., Rye, N. Y. CD 11/7/56.

▲ **Ind., Indianapolis**—SCHOOL—Warren Twp., 8400 E. 10 St., plans by Everett I. Brown & Assocs., Illinois Bldg., high school, E. 16 St., near Post Rd., $3,500,000, CD 5/9/57.

▲ **Iowa, Ames**—HOSPITAL—City, City Hall, voted $600,000 bonds, Mary Greeley Memorial Hospital addn., $1,500,000. Dane D. Morgan & Assocs., 314 N. 4 St., Burlington, archts., Herbert D. Arthur, Ames, assoc. archts.

Iowa, Lake Mills—SCHOOL—Bd. Educ., voted $550,000 bonds, elementary school and high school addn.

▲ **Mass., West Boylston**—SCHOOL—Towns Berlin and Boylston, supt. schools, Crescent St., regional high school. $1,500,000. Constr. 1959.

Mo., Fayette—HOSPITAL—Howard County, Court House, 50-bed county hospital. $750,000. 9/11/58.

▲ **N. J., Bloomfield**—APARTMENT—John Fuller, 850 Broad St., Newark, plans by Joseph D. Scrocco, 12 Rock Spring Rd., West Orange, constr. 73-family, garden type apartment, 3-acre tract, Belleville Ave., $1,000,000.

▲ **N. J., Gloucester**—SCHOOL—Bd. Educ., plans by Edwards & Green, 17 S. 5 St., Camden, junior-senior high school and elementary school alterations, $2,000,000.

O., Dover—SCHOOL—Tuscarawas Valley Local School Dist., bond election Nov. 4, high school, $970,000. McLaughlin & Keil, 500 Dominion Bldg., Lima, archt.

▲ **O., Norwalk**—POWER PLANT—City, City Hall, modernization power plant, $2,200,000. Alden E. Stilson & Assoc., 245 N. High St., Columbus, engrs.

▲ **Okla., Duncan**—SCHOOL—Bd. Educ., $1,300,000 bond election 10/21, high school. CD 3/29/57.

Pa., Broomall—SCHOOLS—Marple Newtown Jt. School Bd., Newtown Square, plans by Baader, Young & Schultze, 1500 Walnut St., Phila., junior high school $750,000. CD 11/18/55.

▲ **Pa., Mechanicsburg**—SCHOOL ADDITION—Cumberland Valley Joint School Dist., R. D. 1, plans by E. G. Good., 904 N. 2nd. St., Harrisburg., high school addn., New Kingston, $1,250,000. Bids in Oct.

▲ **Tex., Corpus Christi**—HIGH SCHOOL—Corpus Christi Ind. School Dist., 515 N. Carancahua St., plans by McCord & Lorenz, 305 Beverly Bldg., archts.-consult. engrs., high school. $1,000,000. CD 5/14/52.

▲ **Vt., Burlington**—NUCLEAR POWER PLANT—Municipal Light Dpt., City Hall. Nuclear Power Plant. $22,000,000. J. F. Pritchard & Co., 4625 Roanoke Pkwy., Kansas City, Mo. and Westinghouse Electric Corp., P.O. Box 868, Pittsburgh, Zone 30, Pa., consult. engrs.

▲ **Wash., Seattle** — AQUARIUM—City County—City Bldg., Seattle 4, Wash., saltwater aquarium in Golden Gardens Park, $1,100,000 Work may start 1959.

▲ **Wis., Menomonie**—COURTHOUSE—Dunn Co., courthouse, $1,000,000.

Ont., Brockville—COLLEGIATE INSTITUTE—Bd. Educ., P.O. Box 126, plans by Barnett & Rieder, 279 Queen St. S., Kitchener, Ont., collegiate institute, $830,000. CD 5/8.

COMMERCIAL BUILDINGS

▲ **Calif., San Rafael**—RECREATION CENTER, etc.—Massberg & McKillip, c/o Fred Massberg, 20 Van Tassel Court, Sleepy Hollow, Calif., plans by Wm. B. Reiner, 1097 B St., Hayward, Calif., recreation center, etc., Vivian and Belvedere Sts. $2,500,000. Constr. within six weeks.

▲ **Colo., Denver**—CLUB HOUSE—Pinehurst Club, Corp. c/o Walter A. Keelbel, Pres., 1845 Sherman, 50,000 sq. ft. club house, golf course, tennis courts, 3 swimming pools, $1,500,000.

▲ **Conn., New Haven**—ART AND ARCHITECTURE BLDG.—Yale University, 119 College, plans by Paul Rudolph, Dpt. Architecture Yale Univ., multi story, 102,000 sq. ft. classroom bldg. School of Art and Architecture, $2,500,000. Henry A. Pfisterer, 111 Whitney Ave., consult. engr. CD 6/3.

▲ **Conn., Wallingford**—SHOPPING CENTER—Food Fair Properties, 99 Park Ave., New York, N. Y. plans by Lathrop Douglas, 518 5th Ave New York, N. Y. shopping center No. Colony Rd., $1,000,000 Leon Selzer, 200 W. 57 St., New York, N. Y. consult. engr. Sydney W. Barbanel, 29-46 Northern Blvd. Long Island City, N. Y. mech. engr.

▲ **Fla., Miami**—HOSPITAL—Miami Baptist Hospital, Inc. 1324 West Flager St., plans by Sherlock, Smith & Adams 303 Washington Ave., Montgomery, Ala. 1 and 5 story, RIC, steel and masonry, hospital, $3,000,000 Charles Payne & Assocs., 4100 N. Miami Ave., consult. engrs. CD 4/2.

Fla., Orlando—CHURCH—First Baptist Church, S. Main St., plans by Ivey & Crook, Candler Bldg., Atlanta, Ga., church. $750,000.

▲ **Ill., Aurora**—HOMES—W. R. Contratto, 2010 Prairie Ave., 145 homes, Beau Ridge Subd., Sullivan Rd., $2,000,000.

▲ **Ind., Fort Wayne**—SHOPPING CENTER—Northcrest Shopping Center, Ralph Shirmeyer, Inc., c/o Norbert Knapke, Lincoln Bank Tower, 30 store shopping center, 50 acre site, California Rd. between US 27 and State Road 427, $1,000,000. Bids about mid-Sept. A. M. Strauss & Assocs., Strauss Bldg., archts. CD 3/15/55.

▲ **Iowa, Sioux City**—HOME FOR AGED—Lutheran Synod of Iowa, South Dakota and Nebraska, c/o William Beuttler & Son, archts., 14 and Nebraska Sts., rein.-con. Martin Luther Home for Aged, $3,000,000. Frank L. Pulley, 720 Securities Bldg., Des Moines, consult. engr. CD 12/18/56.

▲ **Ky., Louisville**—MOTEL, etc.—Fred Walters, 7911 Reading Rd., Cincinnati, O., plans by Ed Lipson & Assoc., 1607 Asmann, Cincinnati, O., 196-unit motel, restaurant at Ky. Fair and Exp. Center. $1,500,000.

▲ **Mass., Falmouth** — HOSPITAL—Falmouth Hospital Assoc., 230 Main St., hospital. $1,000,000. Constr. 1959. 9/11/58.

▲ **Mass., Scituate**—SHOPPING CENTER—Owner, c/o Koller Assoc., archt., 198 Richardson Rd., Newton Upper Falls, Mass., garden type shopping center. $1,800,000. Constr. 1958.

▲ **Minn., Edina (P.O. Minneapolis)**—APARTMENT—Southdale Realty Co., 3500 West 66th St., eight bldg. apartment, 65th St. and Drew Ave. south. $1,000,000.

▲ **N. J., Morristown**—STORE—Elblum Holding Corp., 10 Park Place, Bamberger store addn., Speedwell Ave., $1,000,000.

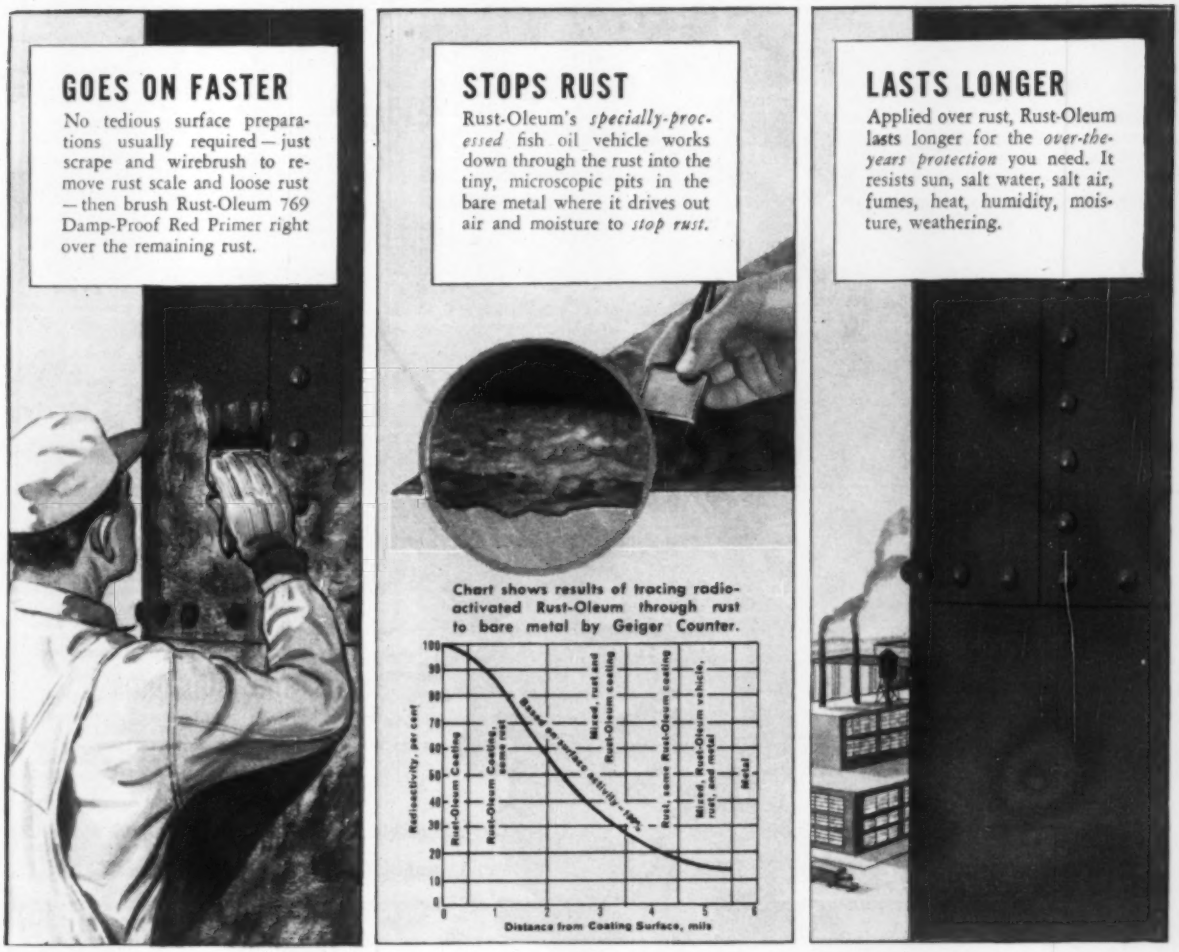
▲ **N. Y., Brooklyn**—APARTMENT—Marbreen Holding Corp., 16 Court St., Brooklyn, Zone 2, plans by Seelig & Finkelstein, 153 Pierrepont St., Brooklyn 2, N. Y., 6 story apartment for 145 families and 90-car garage, 345 Webster Ave. $1,300,000.

▲ **N. Y., Brookville**—DORMITORIES—C. W. Post College, Long Island University, Brookville, plans by Kelly & Gruzen, 80-5th Ave., New York, N. Y., archts.-engrs., two dormitories. $3,000,000. Bids September 1960. CD 3/17.

▲ **N. Y., New York**—APARTMENT—Third and Thirty-Fifth Corp., 19 W. 44th St., New York, Zone 36, plans by H. I. Feldman, 415 Lexington Ave., New York 17, N. Y., 14 story apartment, 1328-42 Second Ave. and 301-3 E. 70 St. and 300-4 E. 71 St. $1,900,000.

(Continued on page 158)

Three Rust-Oleum DIFFERENCES that save you time, money and metal!



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No tedious surface preparations usually required — just scrape and wirebrush to remove rust scale and loose rust — then brush Rust-Oleum 769 Damp-Proof Red Primer right over the remaining rust.

STOPS RUST

Rust-Oleum's *specially-processed* fish oil vehicle works down through the rust into the tiny, microscopic pits in the bare metal where it drives out air and moisture to *stop rust.*

Chart shows results of tracing radio-activated Rust-Oleum through rust to bare metal by Geiger Counter.

Radioactivity, per cent
Rust-Oleum Coating
Rust-Oleum Coating, some rust
Based on surface activity = 100%
Mixed, rust and Rust-Oleum coating
Rust, some Rust-Oleum coating
Mixed, Rust-Oleum vehicle, rust, and metal
Metal
Distance from Coating Surface, mils

LASTS LONGER

Applied over rust, Rust-Oleum lasts longer for the *over-the-years protection* you need. It resists sun, salt water, salt air, fumes, heat, humidity, moisture, weathering.

These are just a few of many important *differences* that separate Rust-Oleum from ordinary coatings. When you consider that Rust-Oleum covers approximately *30% more area,* depending upon surface condition and porosity . . . and the fact that Rust-Oleum finish coatings, with the same fish oil vehicle, are available in nearly every color for *double protection* . . . it's just good, common sense to use Rust-Oleum. Prompt delivery from Industrial Distributor stocks. Write for illustrated literature with color charts.

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(Continued from page 156)

▲ **N. Y., New York**—APARTMENT—357 E. 71 Corp., c/o Philip Birnbaum, archt., 12 E. 48th St., New York, Zone 17, N. Y., 20 story apartment, 360 E. 72 St. southwest corner First Ave. **$4,000,000.**

▲ **N. Y., Olean**—FRIARY—St. Bonaventure University, Olean, plans by Brother Cajetan Baumann, 44 Whitehall St., New York 4, N. Y., friary. **$2,000,000.**

▲ **O., Cincinnati**—HOSPITAL—St. George Hospital, 3156 Glenmore Ave., plans by A. V. Walters, 707 Race St., 250 bed hospital addn., **$6,000,000.** CD 5/14/57.

▲ **O., Cleveland**—WOMENS DORMITORY—Western Reserve University, 10940 Euclid Ave., zone 6, plans by Outcalt, Guenther & Assoc., 13124 Shaker Sq., zone 20, 440 unit womens dormitory, Flora Stone Mather College, Western Reserve University, **$2,000,000.** Constr. early 1959. CD 6/19/57.

▲ **Pa., Harrisburg**—MERCHANDISING CENTER—Owner, c/o archts., Steel & Lenker, archts., 103 N. 2nd St., Harrisburg, merchandising center for building industry, shopping center and motel, Route 230 By-pass east of Harrisburg, **$2,000,000.**

▲ **Pa., Phila.**—SHOPPING CENTER—Food Fair Stores, Inc., 2223 E. Allegheny Ave., plans by Louis Kasoff, Co. archt., shopping center, Front St. and Godfrey Ave. Over **$1,000,000.** Bids soon.

▲ **Pa., Phila.** — HOSPITAL — Kensington Hospital, 136 W. Diamond St., plans by Sabatino & Fishman, 116 19th St., Philadelphia, Pa., Maimonides hospital, Conshohocken State Rd. **$2,300,000.** Bids soon. CD 9/24/56.

▲ **Pa., Radnor**—APARTMENT BLDG.—Landrover Gardens, Inc., c/o Aaron Colis, 1117 S. 17th St., Phila., archt., apt. bldg., swimming pool, parking area, **$2,000,000.**

Ont., Toronto—APARTMENT—Globus Constr. Co. Ltd., 49 Neptune Dr., apartment bldg., 163-5-7 Jamieson Ave., **$620,000.**

Ont., Toronto — APARTMENT — Grossman & Roth, 246 Vaughn Rd., 117 suite apartment, Jamieson Ave., **$936,000.**

▲ **Man., Winnipeg**—ADMINISTRATIVE HEADQUARTERS—Manitoba Telephone Sys., 166 Portage Ave. E., 60,000-80,000 sq. ft. administrative headquarters, Portage Ave., at Empress St. **$1,500,000.**

▲ **Que., L'Assomption**—HOSPITAL—Hospital General de L'Assomption c/o Dr. L. Forest, 200 Beaupre, hospital, **$1,000,000.**

INDUSTRIAL BUILDINGS

▲ **Calif. Stockton**—PLANT—Mexico Refractories Co. Mexico, Mo. refractories Plant **$2,000,000.**

Fla., Hialeah—PLANT—Lawnite Co., 2400 NW 75 St. Miami, 1 story, 300 x 720 CB-S manufacturing and office bldg., near Seaboard Air Line Railway, **$750,000.** Bids soon, Shinn & Hutcheson, 401 Coral Way, Consults. engrs. Weiss & Hertz, 2904 Salzedo Ave., Coral Gables, mech. engrs.

Ill., Chicago—PLANT & OFFICE—Wyler & Co., 1050 W. Fullerton Ave., plans by Friedman Alschuler & Sincere, 223 W. Jackson Blvd., 1 story, 54,000 sq. ft., brick dehydrated food plant and office, NW corner Campbell Ave. and Addison St., **$500,000.**

▲ **N. J., Marlboro**—PLANT—Fritzsche Bros., Inc., 85 3 Ave., Clifton, perfumes and food essences manufacturing plant, **$1,000,000.**

▲ **O., Columbus**—DEPOT—Midwestern Volkswagen Corp., 1855 Northwest Blvd., 1 story central parts depot, Kinnear Rd., industrial area, office admin. bldg., retail service outlet, **$1,000,000.**

O., Solon—PLANT—Bird Electronic Corp., 1800 E. 38 St., Cleveland, Zone 14, 40,000 sq. ft. plant, Aurora Rd., **$500,000.**

Tex., Baytown—PLANT—Humble Oil and Refining Co., 1216 Main St., Houston, Polypropylene plant **$13,000,000;** repair shop **$200,000** CD 1/29.

Tex., Odessa—PLANT—Southwestern Portland Cement Co., El Paso Natural Bldg., El Paso, cement mfg. plant **$750,000.** Kenneth Esmond & Assocs., 419 W. 5th St., Odessa, Tex., consult. engrs.

UNCLASSIFIED

Ala., Alexander City—SUB-STATION, etc.—Light & Water Dpt., City Hall, sub-station and reworking electric feeder lines. **$500,000.**

▲ **D. C., Wash.**—STADIUM—District of Columbia Armory Board, 2001 E. Capitol St., 50,000 seat stadium, Independence and Constitution Ave. SE., **$7,000,000-$8,000,000.** Authorization from Congress received. Praeger-Kavanagh-Waterbury, 126 E. 38 St., New York, N. Y., consult. engrs.

▲ **Mississippi** — TRANSMISSION LINES, etc. — South Mississippi Electric Power Assoc., Collins, Miss. sys. imprvts. and extenions incl. power generating plant and transmission lines. **$1,397,000.**

▲ **Ohio**—MICROWAVE RADIO RELAY ROUTE—American Telephone and Telegraph, 195 Broadway, New York, N. Y., microwave radio relay route between Toledo and Dayton, four towers and repeater bldgs. at Fletcher, Cairo, Hamler and Berkey, **$1,800,000.**

▲ **Tex., Houston**—STADIUM, etc.—Harris County Park Comm., Harris County, Courthouse, plans by Lloyd & Morgan, 4605 Montrose Blvd. and Wilson, Morris Crain & Anderson, 3330 Graustark, stadium **$6,000,000.** paved parking area, **$3,000,000** coliseum **$6,000,000** exposition and livestock, **$2,000,000.** utilities, exposition, livestock, coliseum areas **$2,000,000.** CD 8/1.

(Proposal Advertisement see pp. 176 to 178)

"We Found It Cheaper To Move Our Erie Plant Than to Make a 7-Mile Haul"

Gene Obermeyer

The TPA-TPC can be erected and ready for operation in 3 hours. Both units are wheel-mounted and move on 2 truck tractors. All conveying and batching equipment is permanently attached. Nothing is removed either for transit or operation. Wheels do not have to be dismounted when unit is set up.

Fully powered aggregate conveyor needs no field work. No poured foundations required. Furnished base is adequate for all normal load-bearing soil. Capacity: 60 cu. yds. per hr. with 3-yd. batches. The 3-compartment bin capacity is 28 yds. heaped. Cement silo holds 175 bbls.

Carl Goodwin and Sons are helping to relocate U. S. Route No. 131 across Michigan. Near the town of Martin, they moved their new Erie Plant 7 miles down the right of way to pour 600 yds.

"It's cheaper to move our new Erie Plant than it is to truck ready mix to pouring sites even when it's only a 7-mile haul," said Gene Obermeyer, Goodwin's superintendent.

Mr. Obermeyer's experience is typical of the records Erie's new TPA-TPC is hanging up in the field. Low cost portability that beats even a 7-mile haul.

As a practical operator, you know that speed of itself is not the true measure of efficiency. But when a plant lets you pour more yardage per hour and lets you cut down on the number of truck mixers at the same time, that is real economy . . . the kind that rings the cash register . . . the kind you're interested in.

As a cost-minded operator you'll want to know more about Erie's portable equipment and what it can do for you. Let us send you our descriptive bulletin.

All it takes is 2 small truck tractors to move the Erie TPA-TPC portable. Both units meet all highway limitations.

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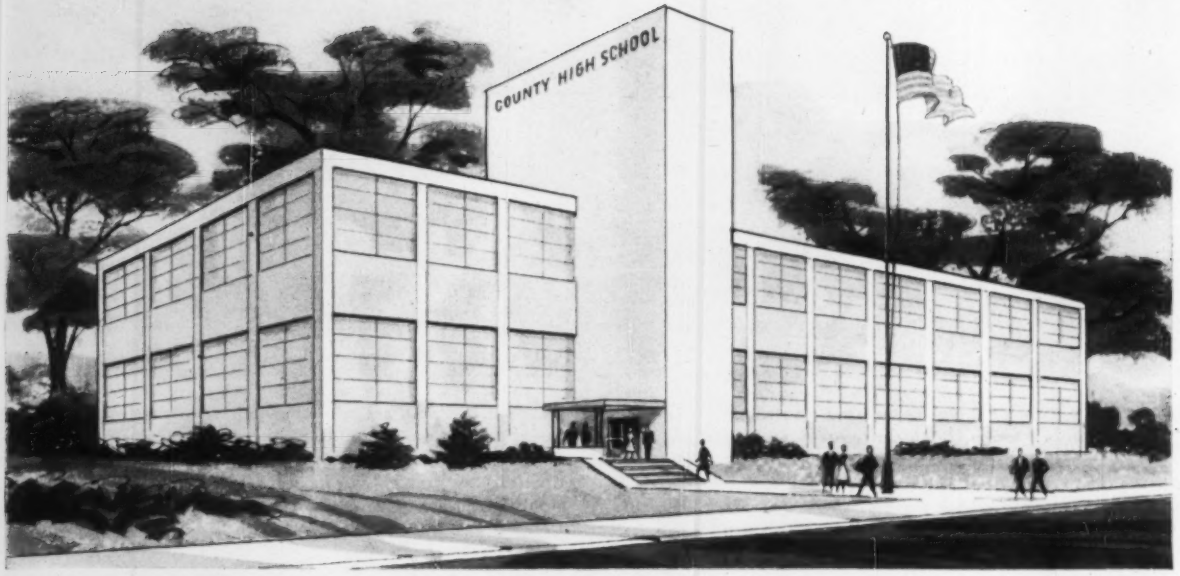
No need to reseal every few years . . .

SEALANTS BASED ON LAST MUCH



Modern elastomeric sealants based on THIOKOL liquid polymers are reducing remedial costs. Structures stay sealed for years and years (probably for the life of the building)—despite the most unfavorable weather conditions. The result is low, low maintenance costs . . . because elastomeric-type sealants eliminate the need for constant resealing.

Elastomeric sealants are not just *improved* sealing compounds; they are an entirely *new type* of sealant—a sealant with a synthetic rubber base which provides truly remarkable resistance to heat, cold, wind, chemicals, and other hazards which cause conventional caulking compounds to deteriorate quickly.

It is no wonder, then, that many architects specify only THIOKOL liquid polymer-based sealants when planning the construction of today's most modern buildings.

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Elastomeric-type sealants are virtually unaffected by severe temperature extremes which usually deteriorate ordinary sealing compounds. Year in, year out, these modern sealants maintain a firm, yet flexible seal—with no softening or bleeding during summer, and no cracking or shrinking during winter. In fact, whether the thermometer reads 200° *above* zero or 100° *below* zero, you can always depend on THIOKOL liquid polymer-based sealants to hold joints tight, allowing no leakage.

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The continuous beating of wind and rain has no serious effect on joints sealed with THIOKOL liquid polymer-based sealants. During simulated hurricane storms (125 mph winds, and 12 inch per hour rains) these sealants adhere perfectly with absolutely no weakening of the seal. They also withstand the jarring impact of excessive vibration caused by subways or heavy vehicular traffic. In addition, elastomeric-type sealants are totally resistant to the damaging effects of oils, gases, solvents and chemicals.

Easy to apply to most building materials . . . masonry, wood, glass and metal

One of the most important features of the THIOKOL type elastomeric sealants is that they adhere to most building materials – making them suitable for a wide variety of uses. These sealants consist of a two-package system – a base material and a curing agent which is added just before use. The sealants convert to flexible rubber seals at ambient temperatures.

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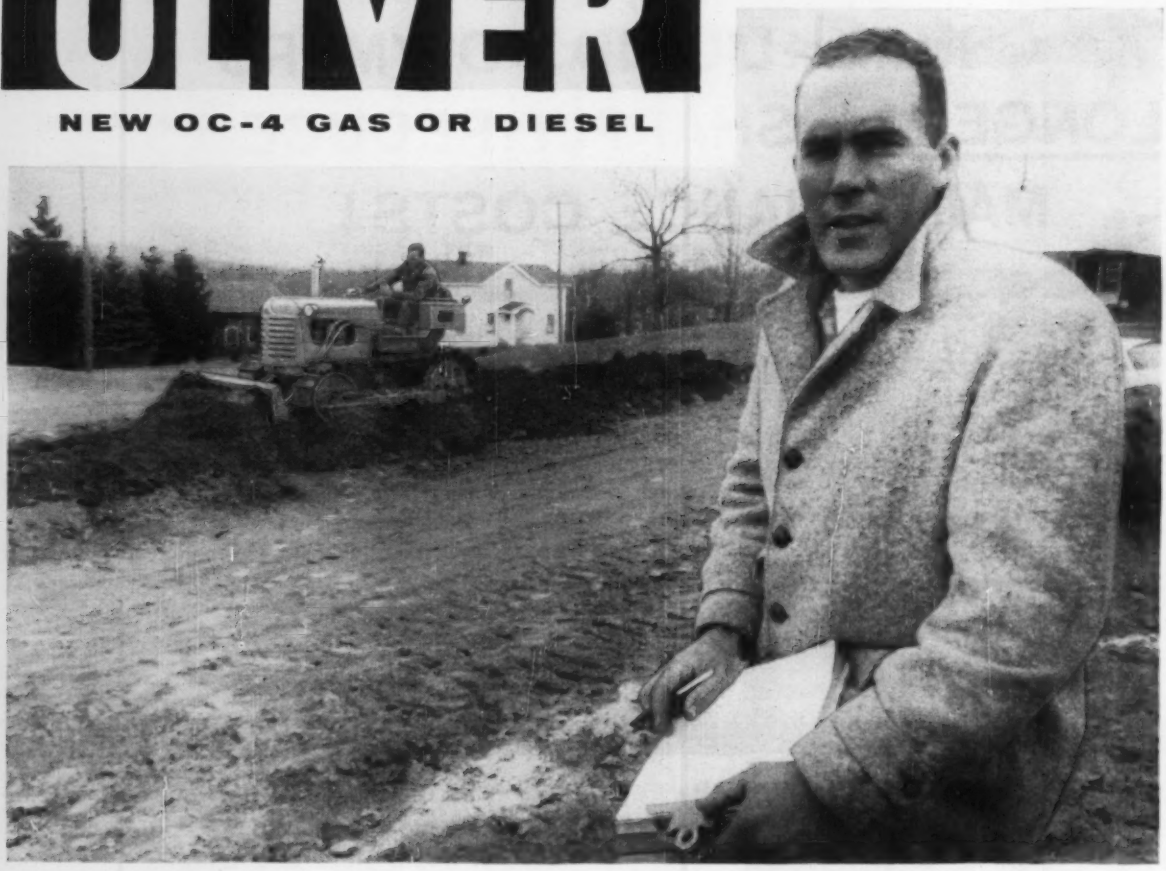

Pier Kooistra says,

"The new Oliver OC-4 costs only $3 a day to operate* and cuts working time two-thirds!"

Handling a variety of work which includes excavating, paving, landscaping, septic tank installation, etc., Pier Kooistra of Preakness-Wayne, New Jersey, has experience with plenty of tractors. Visited on this job where he is stripping topsoil preparatory to excavating for a basement, he said, "The new OC-4 is just the machine for me. On similar jobs I've hired larger machines with costs of about $40 a day more than I pay to use my own OC-4."

What's more, he states that the new OC-4 has more traction-maneuvering on soft ground than any other machine he has ever seen or operated.

He concluded, "I'd much rather own five OC-4's than two or three larger machines because I'll make more money with less operating capital." There's a thought worth examining further. Ask your Oliver distributor. He can give you the arithmetic that will save you money.

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Oliver OC-4—a compact, powerful machine. "Here's the trailer I use to haul the OC-4 from job to job. For a heavier machine it would cost me at least $1000 more for a used truck or $3000 for a new truck—plus everything else that costs more," says Mr. Kooistra. Get the facts about the new OC-4 before you buy.

OLIVER

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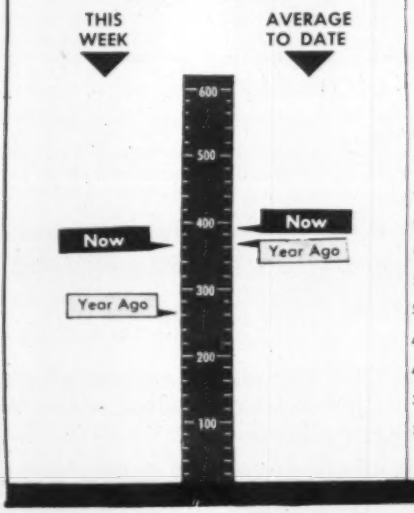
Industrial Division, 19300 Euclid Ave., Cleveland 17, Ohio

a complete line of industrial wheel and crawler tractors and matched allied equipment

Construction Scoreboard

ACTIVITY THIS WEEK

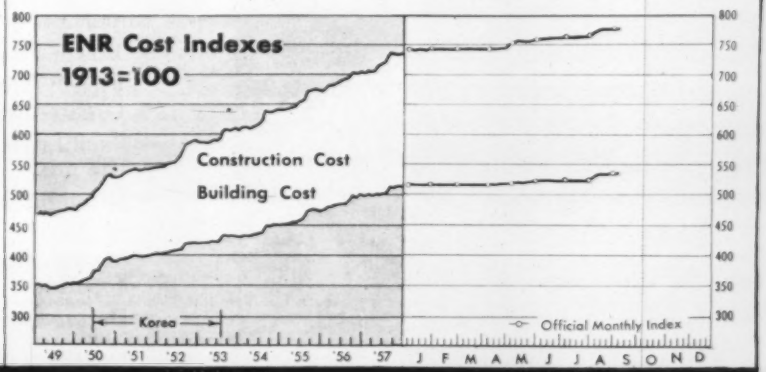
Contract Awards
Millions of Dollars



COST INDEXES AS OF NOW

ENR INDEXES (1913=100), 20-cities' average	Week of Sept. 4 1958	% Change from Aug. 7 1958	% Change from Sept. 5 1957
Construction Cost	774.42	+0.5	+5.0
Building Cost	535.83	+0.7	+3.8

To convert above indexes to 1926 = 100: Divide Construction Cost by 2.080; Building Cost by 1.850
1949 = 100: Divide Construction Cost by 4.770; Building Cost by 3.518



AMOUNT OF CONTRACTS LET

By Ownership	This Week millions	Cum. 37 wks 1958	Chge '57-'58 %
All Heavy Constr.	$360.7	$14,376.7	+7
Private	104.6	5,891.6	−4
Public	256.1	8,485.1	+17
State & Municipal	219.5	6,154.9	+13
Federal	36.6	2,330.2	+26
By Type of Work			
Public			
Waterworks	4.1	227.8	−10
Sewerage	11.7	448.3	+14
Bridges*	11.4	515.2	−2
Highways	134.2	2,525.5	+12
Earthwork, Waterways	10.4	795.3	−5
Buildings, Excl. Housing	59.9	1,937.7	+17
Housing	13.5	931.7	+88
Unclassified	10.9	1,112.7	+30
Private			
Mass Housing	67.2	2,837.3	+31
Commercial	20.1	1,392.0	+9
Industrial	14.8	1,326.6	−43
Unclassified	2.5	326.6	−9

* Includes private bridges.

NOTE: Minimum size projects included are: Waterworks and waterways, $44,000; other public works, $73,000; industrial buildings, $93,000; other buildings, $344,000.

NEW CAPITAL FOR CONSTRUCTION

	Week of Sept. 4 millions	Cum. 36 wks 1958	Chge '57-'58 %
Corporate Securities	$4.6	$3,810.6	−7
State and Municipal:			
All Except Housing	130.3	4,503.7	+17
Housing	...	33.8	−78
Federal Loans	...	137.7	−17
Federal Aid	...	216.2	−90
Total Nonfederal	$134.9	$8,702.0	−16
Federal Appropriations:			
Projects in U. S.	...	$3,946.1	+42
Outside U. S.	...	12.8	−56
Total New Capital	$134.9	$12,660.9	−4

CONTRACTS AWARDED

	1958 August (millions)	1958 8-Mos. (millions)	% Change from 1957 Aug.	% Change from 1957 8-Mos.
Total U. S., ENR reported	$1,621.7	$13,731.6	+12	+7
Private	721.4	5,715.4	+6	−3
Public	900.2	8,016.2	+18	+24
State and Municipal	733.0	5,763.0	+16	+13
Federal	167.2	2,253.1	+28	+24
ENR Volume Index, 1913=100	575	567	+9	−2

NEW CAPITAL FOR CONSTRUCTION

Total U. S.	$4,015.1	$12,526.0	+22	−2
State and Municipal Bond Sales	336.5	4,407.2	−41	+14
Corporate Security Sales	341.2	3,806.0	−13	−3
Federal Loans, Aid (nonfederal work)	234.3	353.9	+1,685	−85
Federal Appropriations (federal work)	3,103.0	3,958.9*	+34	+44

*Includes funds for outside U.S.

MATERIALS SHIPMENTS

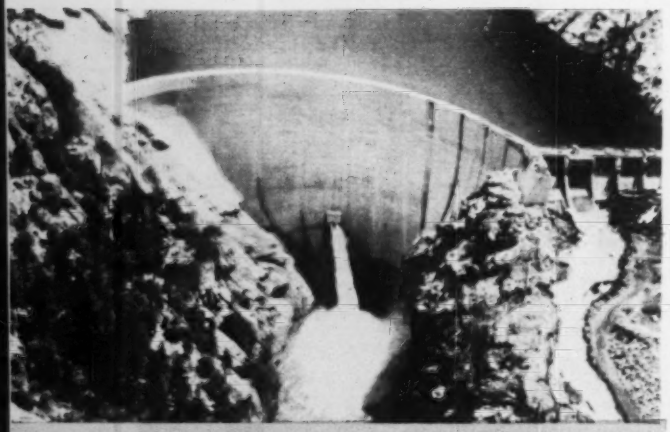
Unit	1958 May June July (M) (J) (Jy)	Cum. (No. of Mos.)	Percent Change from Year Ago Mo.	Cum.
Portland Cement, Bureau Mines, thous bbls	32,281(Jy)	160,326(7)	+26	+4
Concrete Paving Awards, PCA, thous sq yd	17,842(Jy)	73,059(7)	+101	+19
Fabricated Structural Steel, thous tons	290(Jy)	2,207(7)	−15	−9
Bookings, AISC, thous tons	331(Jy)	1,594(7)	+55	−25
Reinforcing Bars, Net, AISI, thous tons	274(J)	1,007(6)	+18	−25
Lumber, NLMA, mil fbm	2,825(Jy)	18,856(7)	+0.4	−6
Orders, mil fbm	3,063(Jy)	18,778(7)	+8	−6
Production, mil fbm	2,716(Jy)	18,159(7)	−0.4	−8
Clay Products, Bureau of Census				
Brick, Unglazed, Common, Face, mil bri	598.6(M)	2,221.5(5)	+2	−1
Vitrified Clay Sewer Pipe, thous tons	155.4(M	587.8(5)	+2	−9
Structural Tile, Unglazed, thous tons	52.8(M)	210.9(5)	+2	−13
Asphalt Products, Bureau of Census				
Asphalt Roofing, thous sales sqs	6,235.2(J)	26,732.2(6)	+38	+10
Asphalt Siding, thous sales sqs	92.3(J)	438.5(6)	+23	−9
Aluminum, Wrought Net, Bur Census				
Sheet and Plate (non-heat treatable), mil lbs	83.0(J)	450.0(6)	+2	−8
Wire and Cable, mil lbs	23.6(J)	131.0(6)	−1	−12
Extruded Shapes (soft alloys), mil lbs	62.1(J)	307.2(6)	+8	−1

EMPLOYMENT AND FAILURES

Contract Const Employment, BLS, thous	2,908(Jy)	2,540(7)**	−5	−8
Contractor Failures, Dun & Bradstreet				
Number	181(Jy)	1,313(7)	+18	+7
Liabilities, thous	$13,966(Jy)	$72,275(7)	+83	+8

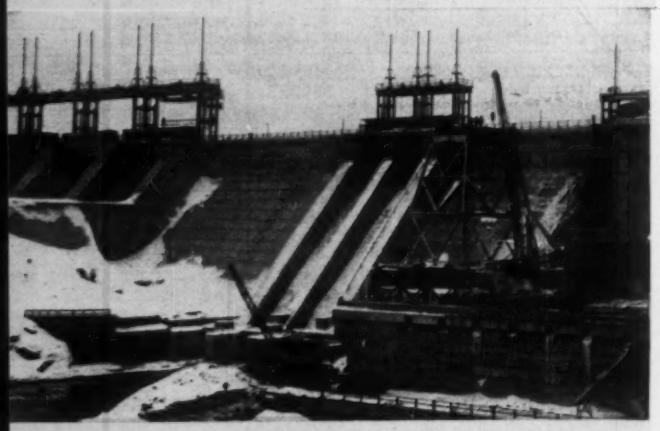
**Average per month

POZZOLITH, produces important



DONNELLS DAM, Oakdale, California; DESIGN ENGR.: George E. Goodall Co. PROJECT ENGR.: Tudor-Goodenough; CONTR.: Morrison-Knudsen Co., Inc., Macco Corp., Peter Kiewit Sons' Co., Stolte Inc.

YAKUWA DAM AND POWER STATION; Asahi Village, Yamagata Pref., Japan; OWNER: Tohoku Electric Power Co.; CONTR.: Obayashi-Gumi.



PERIBONKA NO. 2 DAM, Chute a la Savane, Quebec; OWNER: The Aluminum Company of Canada, Ltd., Montreal Quebec; CONSLTG. AND DES. ENGRS.: Shawinigan Engrg. Co., Ltd., Montreal, Quebec; CONTR.: Pentagon Construction Co., Ltd., Montreal, Quebec.

POZZOLITH* controls entrained air, controls rate of hardening and provides lowest water-content, thereby producing a combination of the following important benefits:

- Lower rate of temperature rise and lower temperature peak.
- Greater flexibility in mixing and placing schedule.
- Facilitates re-vibration and reconsolidation of the mix.
- Eliminates cold joints between successive lift layers.
- "Lubricates" pumped and pneumatically placed concrete . . . facilitates re-handling of the mix.
- Better aggregate coating.
- Reduced shrinkage stresses and reduced shrinkage cracks.
- Reduced permeability.
- Increased resistance to freezing and thawing.
- Greater abrasion resistance to silt-laden water.
- Lower cost of concrete in place.

Concrete produced with POZZOLITH is superior in quality, in performance, and in economy to plain concrete and to concrete produced with any other admixture. *Full information on request.*

Engineers and contractors used POZZOLITH in the following dams to meet their performance requirements most economically:

Aerol Dam, Rio, Brazil
Owner: Companhia Auxiliar De Empresas, Electricas Brazileras

Alvin J. Wirtz Dam (See Lower Colorado Project)

Anderson Creek Dam, Du Bois, Pa.
Owner: Du Bois Municipal Water Works
Engr.: Morris Knowles, Inc.
Contr.: Gannett, Fleming, Corddry & Carpenter, Inc.

Beauharnois Dam, St. Lawrence, Quebec
Owner: Beauharnois Light, Heat & Power Co., Ltd.
Engr.: H. G. Acres & Co., Ltd.
Contr.: Dufresne Construction Co.

Brownlee Dam (See Snake River Project)

Castle Rock Dam (See Wisconsin River Project)

Clark Valley Dam, Harrisburg, Pa.
Owner: City of Harrisburg
Engr.: Gannett, Fleming, Corddry & Carpenter, Inc.
Contr.: Edward H. Ellis, Inc.

Conestoga Dam, Wallenstein, Ontario
Engr.: H. G. Acres & Co.
Contr.: C. A. Pitts Construction Co.

POZZOLITH is a registered trademark of the Master Builders Co.

concrete admixture, benefits for dams

Courtright Dam (See Kings River Project)

Chubu Electric Power Co., Ikawa Dam, Japan

Chugoku Power Co. Dams, Japan
Odomari Dam, Sasanamigawa Dam

Dairyland Power Co. Dam, Ladysmith, Wisconsin
Engr.: Fargo Engineering Co.
Contr.: Fegles Construction Co.

Duke Power Co. Dam, Bridgewater, North Carolina
Engineered and Constructed by Duke Power Co.

Fanshawe Dam, London, Ontario
Owner: Upper Thames River Conservation Authority
Contr.: Foundation Co. of Ontario, Ltd., Fred J. Mannix & Co., Ltd.

Gumma Prefecture Dams, Japan
Aimata Dam, Usui Dam

Hells Canyon Dam (See Snake River Project)

Hokuriku Power Co., Asmine Dam, Japan

Horseshoe Dam, Phoenix, Arizona
Owner: Salt River Agricultural Improvement and Power District
Engr.: Leeds, Hill, Barnard & Jevett
Contr.: Arundel Corp. & L. E. Dixon Co., Vineon & Pringle

Impounding Dam, Indiantown Gap, Pa.
Owner: State of Pennsylvania
Engr.: Gannett, Fleming, Corddry & Carpenter, Inc.
Contr.: The Marshall Co.

Kansai Electric Power Co., Tonoyama Dam, Japan

Karnafuli Dam, Kaptai, East Pakistan
Owner: Government of Pakistan
Engr.: International Engineering Co.
Contr.: Utah Construction Co.

Ketchikan Pulp Co. Dam, Ward Cove, Alaska
Engr.: W. E. Shannon & Sons
Contr.: Ward Cove Builders

Kings River Power Project, Fresno, California
Courtright Dam, Wishon Dam
Owner & Engr.: Pacific Gas & Electric Co.
Contr.: Morrison-Knudsen Co., Inc., Walsh Construction Co., B. Perini & Sons, Inc.

Kyushu Power Co. Dams, Japan
Kawakami Dam, Kyuragi Dam, Ouchibaru Dam, Shin-Sugahara Dam

Lake Houston Dam, Houston, Texas
Owner: City of Houston
Engr.: Ambursen Engineering Corp.
Contr.: San Jacinto Equipment Co., & Elmer G. Gardner, Inc.

Lower Colorado River Authority, Marble Falls, Texas
Alvin J. Wirtz Dam, Marble Falls Dam
Engr.: Fargo Engineering Co.
Contr.: Brown & Root, Inc.

Matilija Dam, Ventura, California
Owner: Ventura County Flood Control District
Engr.: Donald Warren & Assoc.
Contr.: Guy F. Atkinson Co., W. E. Kier Construction Co., Bressi & Bevanda Contractors, Inc.

McArthur Falls Dam, Winnipeg, Manitoba
Owner: Manitoba Hydro-Electric Board
Engr.: H. G. Acres & Co., Ltd.
Contr.: Northern Construction Co., J. W. Stewart

McCormick Power Development Dam, Nr. Bai Comeau, Quebec
Owner: Manicouagan Power Co.
Engr.: H. G. Acres & Co., Ltd.
Contr.: Angus Robertson, Ltd.

Mie Prefecture, Miyakawa Dam, Japan

Ministry of Agriculture Dams, Japan
Habu Dam, Hachimandaira Dam, Kasegawa Dam, Kitayama Dam, Ryusai Dam, Totsukawa Dam, Toyokama Dam Toyosawa Dam, Tsuburo Dam, Ure Dam, Yahagi Dam, Yamada Dam

Ministry of Construction Dams, Japan
Aimata Dam, Fujiwara Dam, Upper Magami River Dam, Yuta Dam

Mitchinamekus Main Dam, Mont Laurier, Quebec
Owner: MacLaren Quebec Power Co.
Engr.: Quebec Streams Commission
Contr.: Foundation Company

Miyagi Prefecture, Hanayama Dam, Japan

Nacimiento Dam, Bradley, California
Owner: Monterey County Flood Control & Water Co.
Engr.: Bechtel Corp.
Contr.: Eaton & Smith; James M. Smith

Nippon Aluminum Co., Motosuko Dam, Japan

Oroville Dam, Feather River, California
Owner & Engr.: Pacific Gas & Electric Co.
Contr.: Utah Contracting Co.

Oxbow Dam (See Snake River Project)

Pamouscachiou Dam, Chicoutimi, Quebec
Owner & Engr.: Hydro Quebec
Contr.: Price Bros.

Paulo Afonso Dam, Sao Francisco, Brazil
Owner, Engr. & Contr.: Compania Hidroelectrica do Sao Francisco

Penn Forrest Dam, Hatchery, Pa.
Engr.: Morris Knowles Inc.
Contr.: Lycoming Construction Co.

Petenwell Dam (See Wisconsin River Project)

Peribonka No. 1 Dam, Chute du Diable Isle Mahgne, Quebec
Owner: Aluminum Co. of Canada Ltd.
Engr.: Shawinigan Engineering Co., Ltd.
Contr.: Fraser-Brace Engineering Co., Ltd.

Peribonka No. 2 Dam, Chute a la Savane Isle Mahgne, Quebec
Owner: Aluminum Co. of Canada, Ltd.
Engr.: Shawinigan Engineering Co., Ltd.
Contr.: Pentagon Construction Co., Ltd.

Pine Falls Dam, Pine Falls, Manitoba
Owner: Manitoba Dept. of Mines & Resources
Engr.: H. G. Acres & Co., Ltd.
Contr.: Foundation Co., Bird Construction Co.

Quinnesee Falls Dam, Iron Mountain, Michigan
Owner: Wisconsin-Michigan Power Co.
Engr.: Mead & Hunt, Inc.
Contr.: C. R. Meyer & Sons

Riviere-Du-Loup Dam, Montreal, Quebec
Engr.: Dufresne Engineering Co., Ltd.

Santa Felicia Dam, Piru, California
Owner: United Water Conservation District of Calif.
Engr.: Bechtel Corp.
Contr.: D & H Construction Co.; Macco Corp., M. H. Hasler Construction Co.

Shipshaw Dam, Racine, Quebec
Owner & Engr.: Aluminum Co. of Canada
Contr.: Foundation Co.

Snake River Project, Boise, Idaho
Brownlee Dam, Hells Canyon Dam, Oxbow Dam
Owner: Idaho Power Co.
Engr.: International Engineering Co., Inc.
Contr.: Morrison-Knudsen Co.

Sumitomo Power Co., Sento Dam, Japan

Sutherland Dam, Ramona, California
Owner & Engr.: City of San Diego
Contr.: L. E. Dixon Co., Bent Construction Co., Daley Corp.

Tochigi Prefecture, Hawaji Dam, Japan

Tohoku Electric Power Co. Dams, Japan
Honna Dam, Kaminojiri Dam, Oike Dam, Uwada Dam, Yakuwa Dam

Tokyo Electric Power Co. Dams, Japan
Odagiri Dam, Sasadaira Dam

Tri-Dam Project, Oakdale, Calif.
Owner: Oakdale Irrigation District and South San Joaquin Irrigation District

Beardsley Dam
Design Engr.: International Engineering Co.
Project Engr.: Tudor-Goodenough Engineers
Contr.: Joint Venture - Morrison-Knudsen Co., Inc., Macco Corp.; Peter Kiewit Sons' Co., Stolte Inc.

Donnells Dam
Design Engr.: George E. Goodall Co.
Project Engr.: Tudor-Goodenough Engineers
Contr.: Joint Venture - Morrison-Knudsen Co., Inc., Macco Corp., Peter Kiewit Sons' Co., Stolte Inc.

Tulloch Dam
Design Engr.: International Engineering Co
Project Engr.: Tudor-Goodenough Engineers
Contr.: Arundel Corp. and L. E. Dixon

Vail Co. Dam, Temecula, California
Engr.: George E. Goodall Co., Al Sonderegger
Contr.: Bent Construction Co.

Wakayama Prefecture, Kodakumi Dam, Japan

Warsak Dam, Warsak, Pakistan
Owner.: Government of Pakistan
Engr.: H. G. Acres Co.

Wisconsin River Power Project, Dellwood, Wisconsin
Castle Rock Dam, Petenwell Dam
Engr.: Harza Engineering Co.
Contr.: Consolidated Water Power & Paper Co.

Wishon Dam (See Kings River Project)

Yamagata Prefecture, Akagawa Dam, Japan

Yamanaski Prefecture, Nishiyama Dam, Japan

THE **MASTER BUILDERS** *COMPANY*
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After a Long Drop, Plant Outlays Turn Up

Billions of dollars seasonally adjusted at annual rates

	1957			1958		
	July-Sept.	Oct.-Dec.	Jan.-Mar.	Apr.-June	July-Sept.[1]	Oct.-Dec.[1]
Manufacturing	$16.37	$15.27	$13.20	$11.53	$11.57	$11.86
Durable	8.23	7.57	6.58	5.57	5.48	5.54
Nondurable	8.14	7.70	6.62	5.96	6.09	6.32
Mining	1.24	1.15	1.00	.92	.91	.96
Railroad	1.54	1.26	1.02	.77	.67	.50
Transportation, other than rail	1.81	1.91	1.69	1.40	1.37	1.55
Public utilities	6.64	6.43	5.87	5.97	6.20	6.38
Commercial and other[2]	10.15	10.21	9.63	9.73	9.60	9.77
Total	37.75	36.23	32.41	30.32	30.32	31.02

[1] Estimates are based on anticipated expenditures reported by business in late July and August 1958.

[2] Includes trade, service, finance, communication, construction.

Sources: SEC—Commerce Department

Outlook Better For Plant Construction

The government this week provided the answer to the key remaining question on the business outlook. Businessmen at last have stopped slashing their spending for capital plant and equipment. They now intend to increase these outlays.

This spells better news for construction men. Industrial Building is off 43% for the first 37 weeks of this year.

The year-long decline in capital spending, which started in July 1957, was probably the biggest single factor in the 1957-58 recession. Capital expenditures dropped off 20% in that time—almost $7.4 billion.

But the latest report by the Commerce Department and the Securities & Exchange Commission indicates the downtrend has been slowed in the current quarter. Moreover, businessmen plan to step up spending in the fourth quarter (see table).

Plans now call for outlays of $30,320 million (seasonally adjusted annual rate) on new plant and equipment in the July-September quarter of this year. Then spending will pick up to a $31,020 million rate from October through December.

The rise is not too robust, but it marks the upturn. A similar survey made only three months ago predicted a further decline that was expected to continue through the first half of 1959.

A pickup in capital spending is important not only in itself but for its effect on the entire economy. Expenditures in this sector have a volatile effect, tending to produce greater expansion of construction and new industrial buying in other lines far greater than actual capital outlays.

For the full year of 1958, the government report expects U. S. business to spend approximately $31 billion on new plant and equipment. This would be 16% below the peak in 1957 but still the third highest year on record.

• **Could go higher**—Fourth quarter expenditures might go even higher than anticipated when information for the survey was being gathered in late July and early August. At the time, business was just picking up from a recession low. Business now is expected to pick up sharply this fall and businessmen may like spending even more.

In the vital manufacturing sector, most industries expect either to hold their spending level or slightly increase third quarter outlays above those of the preceding three-month period. Estimated expenditures by manufacturing will rise in the third quarter to $3,139 million, or $200 million over the second quarter.

Only primary metals and the food and beverage industries predict any substantial declines. Significant gains were forecast in the machinery groups and also in transportation equipment.

In the non-manufacturing sector, transportation groups other than railroads expect to cut back an additional $19 million but look for a strong pickup in the fourth quarter.

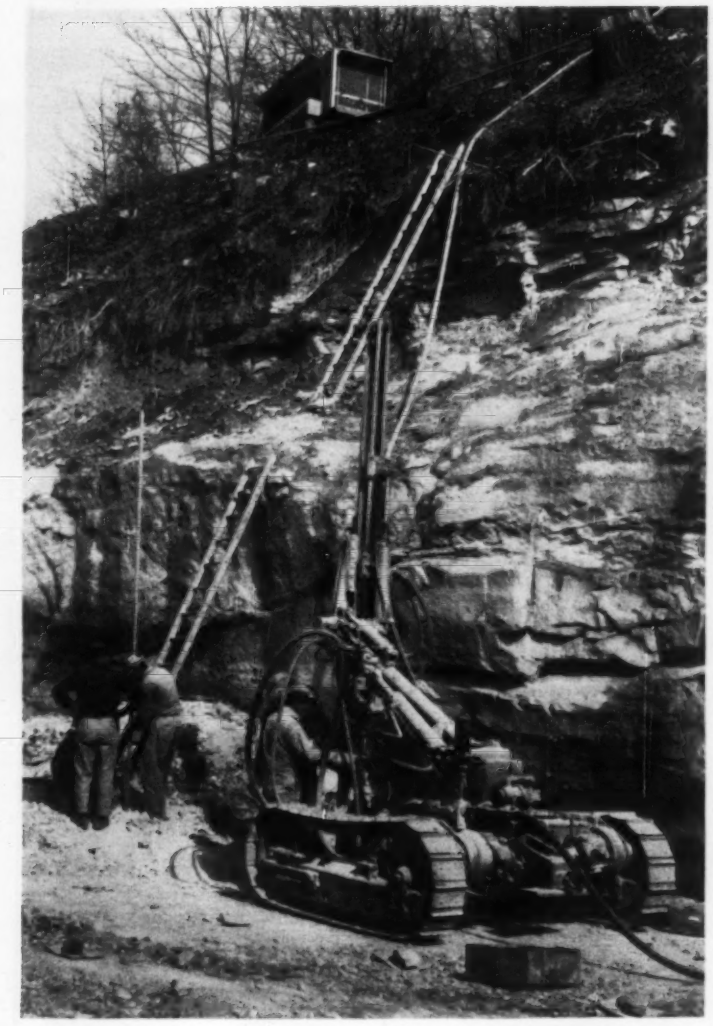
• **Greatest strength**—Public utilities continue to show strength in third quarter plans, with $339 million more planned than in the second quarter. Public utilities, in fact, expect to spend more on capital investment this year than in 1957, the only non-manufacturing industry to do so.

Some decline was predicted, however, in the catch-all "commercial and other" category. This sector accounts for more than a quarter of all capital spending. Expenditures in this group include those made in construction company facilities, and trade, service and finance industries. This group dipped $87 million on an annual rate from the second to third quarters.

Manufacturing industries now anticipate an outlay of $12 billion for all of 1958, a sizable drop from the $16 billion spent in 1957. Durable goods manufacturers forecast a 28% decline in 1958, non-durables a 21% falloff.

Primary iron and steel groups expect a 9% drop in the third quarter but only a further slight decline in the last three months of this year.

(*B&F continued on page 170*)



Ingersoll-Rand

CRAWL-IR

"It's a DRILLIN' FOOL"

says Jim Chase, superintendent for the Haynes Construction Co.

"Does as much work as three wagon drills —and at half the price!"

These are the comments of a veteran rock drill man. And when Jim Chase calls the CRAWL-IR a "drillin' fool," you can be sure his enthusiasm is well deserved.

The unit shown above is being used by the Haynes Construction Company of Bluefield, West Virginia, to do the rock work on a new highway for Charleston's Kanawha County Airport. But rough ground and deep cuts like this were no problem to the fully mechanized CRAWL-IR drill. In fact Jim Chase, superintendent of the job, reported that it easily out-performed three wagon drills—and at half the cost.

Supplied with 100 psi air from a 600 cfm I-R Gyro-Flo compressor, the CRAWL-IR moves from hole to hole under its own power. Five large, double-acting hydraulic cylinders control *all tower motions* at the touch of a throttle. You can set up to drill in any position in a matter of minutes. And the powerful D-45 drill, with reverse rotation, permits adding and removing coupled steels in a hurry.

Time formerly spent in moving the equipment, setting it up and changing steels is now spent *drilling rock*. You get more footage per shift with far less effort than ever before. Ask your I-R man for complete information on the time-saving, cost-saving CRAWL-IR drill and long-life I-R carburized drill steel and Carset bits. Or send today for a copy of Bulletin No. 4189.

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A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK

DOLLAR

Ash disposal line for power plant in Alabama, being constructed with 12" Mechanical Joint Cast Iron Pipe.

Big Business, too, chooses Cast Iron Pipe

Fire protection line for large automotive plant in New Jersey, built with Mechanical Joint Cast Iron Pipe.

MODERNIZED **cast iron**

FOR DOLLAR

Cast Iron Pipe delivers MORE water...LONGER!

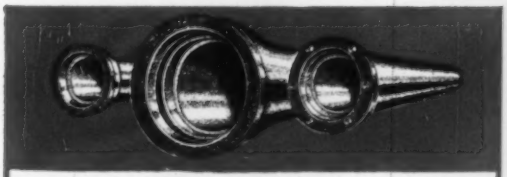
Pipe is a capital investment.

But cast iron pipe is an investment that pays off.

- *In longer life* . . . cast iron pipe serves for centuries.
- *In more efficient operation* . . . cast iron pipe requires little or no maintenance or replacement.

  In taxpayer satisfaction . . . cast iron pipe far outlasts the bond issue that paid for it.

Most important to you, these statements are based on proof, not claims . . . performance, not promise. Specify cast iron pipe, America's most dependable pipe, and be sure, not sorry.



6 reasons why Cast Iron Pipe is #1 choice of U. S. A.

1. HIGH FLOW CAPACITY . . .
   Cement lined cast iron pipe and fittings will not tuberculate . . . delivers a full flow for the life of the pipe.
2. LONG LIFE . . .
   42 North American cities are still using cast iron water mains laid 100 years and more ago. Hundreds more have passed the 50 year mark.
3. BEAM STRENGTH . . .
   Cast Iron Pipe is inherently tough . . . stands up under heavy traffic load, soil displacement and disturbance.
4. EXTERNAL LOAD RESISTANCE . . .
   6" Class 150 Pipe withstands a crushing load of 17,900 pounds per foot . . . nearly 9 tons.
5. CORROSION RESISTANCE . . .
   Cast Iron Pipe effectively resists corrosion . . . vital factor in its long life and dependability.
6. TIGHT JOINTS . . .
   A full range of leak-proof, low cost, easy-to-assemble joints for pipe and fittings are available for all conditions.

THE MAN WHO CHOOSES CAST IRON PIPE TODAY WON'T PAY FOR IT AGAIN TOMORROW!

CAST IRON

Cast Iron Pipe Research Association
Thos. F. Wolfe, Managing Director
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pipe FOR MODERN WATER WORKS

Small Business Gets a Bundle

In its closing hours Congress handed small business and contractors a bundle of good things: tax relief, lower interest rates on small business loans and a $250 million capital bank act that will enable small businesses to get long-term loans.

Most important right away is the $300 million in tax relief. And the most interesting, perhaps, is the capital bank. It will be handled by the Small Business Administration, which already has a loan operation. The loans will not be made directly by the federal agency. They will come from private investment institutions still to be set up. These institutions will get a maximum of $150,000 in federal funds each by selling securities to the SBA. The agency can pad this with direct loans as well.

The new bank promises small contractors a source of long-term capital when it is not available elsewhere. It may not be a bonanza, if SBA's record with direct loans is any indication. Last year the agency gave contractors only 223 loans totaling $11.2 million. (A contractor qualifies as a small business if his receipts were under $5 million annually over the last three years.)

Loans contractors obtain from the investment companies will require SBA approval. They will be for as long as 20 years, with a 10 year extension possible. No limit on amount or interest rate has been set as yet. These and other details need to be settled before the bank's value to contractors can be determined.

The SBA now is working out the administrative details. According to Administrator Wendell B. Barnes, the new program should be operating by January 1. By then, it should be issuing licenses to the investment companies authorized by Congress.

Mr. Barnes reports that more than 2,500 companies and individuals have expressed interest in the program. Regulations and license forms should be available from SBA field offices during the first two weeks of November.

Congress gave the bank $50 million for this fiscal year. It will be asked to add $100 million next year and $100 million the following year.

• **Depreciation write-offs**—The same legislation carried provisions permitting faster depreciation write-offs on new machinery and equipment (ENR Aug. 14, p. 100). Here's how the new regulations work. Take a $10,000 item of equipment with a salvage value of $500 at the end of a 20 year tax life. The first year, the contractor deducts 20% of $10,000, i.e. $2,000. In addition, he applies the usual depreciation to the remaining $8,000. Thus his first year's tax return will include a $2,000 deduction plus $375 if he uses the straight-line method, $800 with the declining balance method, or $714 with the sum of the digits method. The remaining 19 years' depreciation is figured as though the initial cost were $8,000.

The new law applies to investment of up to $10,000, or $20,000 in the case of a joint husband-wife return. Only operating machinery and equipment with a useful life of six years or more are covered. Buildings and inventories are excluded.

Attempts to broaden this provision to cover inventories and larger investments (ENR Aug. 14, p. 100) were defeated.

• **Other tax changes**—Congress also voted to allow business losses to be carried back three years instead of two, as at present, to obtain tax refunds.

Another change permits estate taxes to be paid over a 10 year period instead of the present 15 months if the estate is composed mainly of investments in a closely held business.

Congress also agreed to let corporations with 10 or fewer stockholders be taxed as partnerships.

Finally, Congress passed a measure making the Small Business Administration a permanent agency and raising the limit on its loans from $250,000 to $350,000. Interest rates were dropped from 6% to 5½%.

Airport Construction Set Back

Airport construction plans of state and local governments were pushed back last week when President Eisenhower vetoed the $437 million federal-aid bill.

Local airports took three major setbacks:

• They lose assurance that the existing program will be continued beyond the present cutoff date of June 30, 1959.

• Hopes are dashed for a construction speedup, with $100 million a year of federal matching grants.

• They face a long delay in getting airport allocations for the fiscal year beginning next July 1, despite any effort Congress may make to hasten new legislation.

President Eisenhower explained his veto by saying local communities should assume more responsibility for construction of their airports. But he said he will offer a transitional program to the next Congress to provide aid for urgent airport construction projects essential to national aviation. This aid will gradually taper off.

No early drop in construction will result from the President's action. Airport officials will continue to award contracts this year and next year on the basis of allocations received earlier, but not yet spent. With 50-50 local matching funds, these carry-over grants will finance over $200 million of new airport contracts.

The threat to the future is more serious to local officials. A recent survey showed more than $1 billion of airport construction planned for the four years from July 1, 1958, to June 30, 1962 (ENR July 3, p. 83). Local sources could provide $590 million, but another $475 million would have to be found elsewhere. Airport people had counted on getting this from the bill the President rejected.

Sen. A. S. (Mike) Monroney (D.-Okla.), chief sponsor of the legislation, criticized the President's action. He said it endangers safe transition to the jet age. But some air transport experts discount the charge. The Civil Aeronautics Administration says 14 airports now have runways and fueling systems to take care of big commercial jets. The number of such airports will increase to 62 by mid-1962 under the present program. However, many will still lack other necessary ground facilities to handle big passenger and cargo loads that jets make possible.

Canada Iron Expands Fabricating Network

Three links have been added to Canada's second chain of structural steel fabricating plants. Forged by Canada Iron Foundries Ltd., the chain has grown to rival in coverage the nation-wide organization of Dominion Bridge Co. Ltd. Dominion has 14 plants in 11 Canadian cities; Canada Iron now has seven in seven cities.

The three links were acquired through Canada Iron's subsidiary, Dominion Structural Steel Ltd., and consisted of C. W. Carry Ltd., Edmonton; Calgary Structural Steel Co. Ltd., Calgary; and Western Bridge and Steel Fabricators Ltd., Vancouver. Canada Iron will be able to offer nation-wide services as soon as it acquires facilities in Winnipeg, which it plans to do soon, says T. F. Rahilly, chairman and president.

(B&F continued on page 172)

One set of spare parts serves all these 18 HERCULES engines

Here's parts interchangeability to warm a maintenance man's heart! Hercules designed the new DD diesel and GO gasoline engines with the user in mind: succeeded in achieving a unique degree of interchangeability that reduces spare parts requirements for Hercules-powered equipment to a minimum.

Actually, the illustration above doesn't tell the whole story. To do that, we'd have to show 6 power units as well as all 18 models of 3, 4, and 6-cylinder engines available in the DD and GO series—a total of 24 power plants using many of the same wearing parts!

You can take advantage of this maintenance economy by specifying Hercules diesel, gasoline, or LP-gas power for the equipment you buy. If you'd like the full story on these modern engines, write Hercules Motors Corp., Canton 2, Ohio—or call your Hercules distributor: there's one in the Hercules worldwide network near you.

HERCULES

HERCULES MOTORS CORPORATION
Canton, Ohio

Glen Canyon Dam Project to open vast new area

Work on huge Upper Colorado River Project well under way

When completed some six years hence, the giant Glen Canyon Dam, Reservoir and Powerplant Project will unlock the riches of a vast, 10,000-square-mile area.

The high concrete gravity arch dam, rising 700 feet from bedrock, will contain 5,493,000 cubic yards of concrete. Power from the 900,000 KW power plant, located 470' downstream from the dam, will make possible the development of huge resources of fuel, oil, minerals—including uranium—and timber.

When filled to capacity the 28,000,000-acre-foot reservoir will stretch 186 miles up the Colorado and 71 miles up the San Juan, a major tributary of the Colorado. Basically, this project is for river control and power generation.

Largest single dam contract on record

The $107,155,222 contract for the Glen Canyon Dam and Powerplant, largest ever awarded by the U.S. Bureau of Reclamation, went to Merritt-Chapman & Scott Corporation, New York. On April 29, 1957, the day the contract was awarded, Merritt-Chapman & Scott signed a contract with Fairchild for aerial mapping of the dam site, reservoir and areas adjacent to the dam site. Flying operations began on May 5, *just six days later!* Advance copies of the flying results were delivered on May 26. Other detailed data followed soon after.

Scale of maps for Glen Canyon

Reservoir: 1" equals 400', 10' contours

Dam site: 1" equals 50', 2' contours

Areas adjacent to dam site: 1" equals 200', 5' contours

During the past 34 years, Fairchild crews have flown similar mapping assignments all over the free world. Results produced from this experience have led thousands of Fairchild clients to say... if you want it done *fast* and *right the first time*, you can depend on Fairchild.

Site of the 700' Glen Canyon Dam, second in height only to Hoover Dam (726') is located 12 miles downstream from the Arizona-Utah border—370 miles upstream from Hoover Dam.

Walls of the canyon at the dam site are 650' high with overhang in places. This necessitated flight paths parallel to the walls but offset to see under the overhangs.

FAIRCHILD AERIAL SURVEYS, INC.

Los Angeles, California: 224 East Eleventh Street • New York, New York: 30 Rockefeller Plaza • Chicago, Illinois: 111 West Washington • Long Island City, New York: 21-21 Forty-First Avenue • Tallahassee, Florida: 1514 South Monroe Street • Boston, Massachusetts: New England Survey Service, 255 Atlantic Avenue • Shelton, Washington: Box 274, Route 1 • Houston, Texas: 3325 Las Palmas • Birmingham, Alabama: 2229 First Ave. North

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HY 7-5445

. . . *Business and Finance*

Cement Price War?

Dundee's new plant alarms Lakes' cement industry

A newcomer to U. S. cement manufacturing is causing talk of a possible price war in the industry. The firm is Dundee Cement Co., a subsidiary of Holderbank Financiere, a Swiss holding company. It is constructing a cement plant of 6 million bbl annual capacity near Dundee, Mich., with completion due by spring of 1959.

Some U. S. cement firms are worried that Dundee's output will undersell other firms in the already oversupplied Great Lakes region. But Dundee's treasurer, Dennis Temple, denies this. He told ENR:

"The capacity of the plant being built at Dundee is such that we will have to sell outside that area. However, the new company—although its policy has not yet been announced—will not undersell."

Suspicion of Dundee's plans arises from belief that the Swiss company is in a financial position to undersell because of its diversified holdings. The firm owns cement plants in 21 countries, as well as other interests. Some manufacturers speculate that the new plant will ship bulk cement to construction centers with Great Lakes ports, such as Chicago, and store it there in silos.

An official of the Chicago regional port district told ENR that St. Lawrence Cement Co., a Canadian subsidiary of Holderbank Financiere, has a lease agreement with Calumet Harbor Terminals for a site on which a packaging plant and two concrete silos will be built. The site adjoins Chicago's Calumet Harbor property.

Dundee's move into the market is called "completely unsound" by W. A. Wecker, president of Chicago's Marquette Cement Manufacturing Co. He says consumption in 1957 dropped 7% behind 1956 and estimated that the industry will be producing this year at 80% of capacity.

Business Briefs...

• **Big modernization job**—General Electric Co. plans to spend $47 million for plant modernization at its Pittsfield, Mass., transformer plants during the next five years.

• **Prefabber's sales rise**—Scholz Homes, Inc., of Toledo, reports that sales in the first five months of the current fiscal year were $5.5 million, up 38% over last year's same period. Total housing units shipped rose 61% from a year ago.

NLRB Will Take On "No-Man's Land"

Small contractors will have a chance to take labor cases to board under proposed changes in rules

Either by default or implication, the construction industry has approved the National Labor Relations Board's plan to expand its jurisdiction into the "no-man's land." That's the area in which the NLRB has declined to act on labor disputes since 1954 and where states may not act.

A limited number of comments were received by the board from contractors, but all supported the proposed changes. These will enlarge the board's jurisdiction by lowering the dollar volume of interstate business that must be done to get a case before NLRB. But there is new uncertainty just when and how the new rules will go into effect.

In announcing its plan, the board gave employers and unions until August 16 to submit comments. And it set September 1 for the new rules to go into effect. Pressed for more time to submit comments, the board extended the time to September 2, but did not set a new effective date.

At this point, NLRB members are still studying the comments received and no one knows exactly what the board will do next. This does not mean it is drawing away from the plan to extend jurisdiction. Months were spent developing the new rules. And Congress appropriated an extra $1.5 million at the board's request for the expanded operations.

Though several requests have been made for a full-scale hearing before adoption of the new rules, the board is not likely to adopt this course of action. It has never considered itself bound absolutely by the jurisdictional rules. It's more likely the board will announce that the original proposals are now effective, perhaps with some changes. Since it has already said final standards would be announced on a case-by-case basis, changes in the proposals made last July could be made in future board decisions.

• **The changes**—Despite this delay, it seems certain the board will follow through on its plan to take on about 20% of the cases now in no-man's land. That means many more smaller cases involving contractors will be accepted by NLRB—either unfair labor practice or representation election cases.

Here are the two changes from the 1954 rules that affect the construction industry:

• The dollar volume has been reduced to $50,000 a year. This includes work done outside the state, work done inside the state but for someone in interstate commerce, materials bought outside the state, and materials made outside the state though bought inside the state.

• All disputes with a "substantial" impact on national defense will qualify. Under the 1954 rules, you had to be doing at least $100,000 worth of national defense work under a government contract.

The new proposals do not change the 1954 standard for associations, which treats them as single employers in NLRB cases. So single member employers automatically meet the new requirements if associations they belong to qualify under the standards.

• **The reaction**—Only the second of these proposed changes, dealing with national defense, drew any fire from the construction industry. In fact, only five comments were submitted from the industry: three from chapters of the Associated General Contractors, one from a general contractor, and one from a brick manufacturer. No separate comment was submitted on behalf of any building trades union; the AFL-CIO did comment for itself and member unions, but had no specific reference to construction problems.

The AFL-CIO adheres to its old position that no jurisdictional standards at all should be used by the board to screen out cases. It thinks the board should not say in advance where it will refuse to consider violations of the Taft-Hartley Act. Recognizing the board won't adopt this position, the AFL-CIO generally approves the downward revisions proposed, while supporting individual unions claim the move is not far enough. None of these involves construction, however.

The rule covering national defense work received criticism only from Tucson Pressed Brick Co.; but the uncertainty it finds in the rule probably has troubled many people.

Basically, the company asks what is a "substantial impact" on national defense? Because of the ambiguity, it feels this is a "dangerous" standard, and should be made more specific.

As proposed, says Tucson Brick, small businesses could "not feel secure" in doing any business, either directly or indirectly, on projects related to national defense. Heretofore, a firm knew it came under NLRB's jurisdiction if it furnished $100,000 worth of goods directly related to national defense and performed under a government contract.

Tucson Brick suggests the board spell out a definite dollar amount of business and whether the standard would apply if the goods or services were furnished on a government contract.

• **Contractor comments**—The comments of contractors all praise the proposed standards.

• Charles H. Tomkins Co., Washington, D. C., general contractor, says the proposed changes "are beneficial and will serve to fill an existing vacuum."

• The Washington, D. C. Chapter of AGC says it favors "any action that will alleviate or eliminate the 'no-man's land' now existing."

• The Associated General Contractors of Missouri says it is "extremely desirable . . . that NLRB extend and increase its jurisdiction and take as many cases at it possibly can."

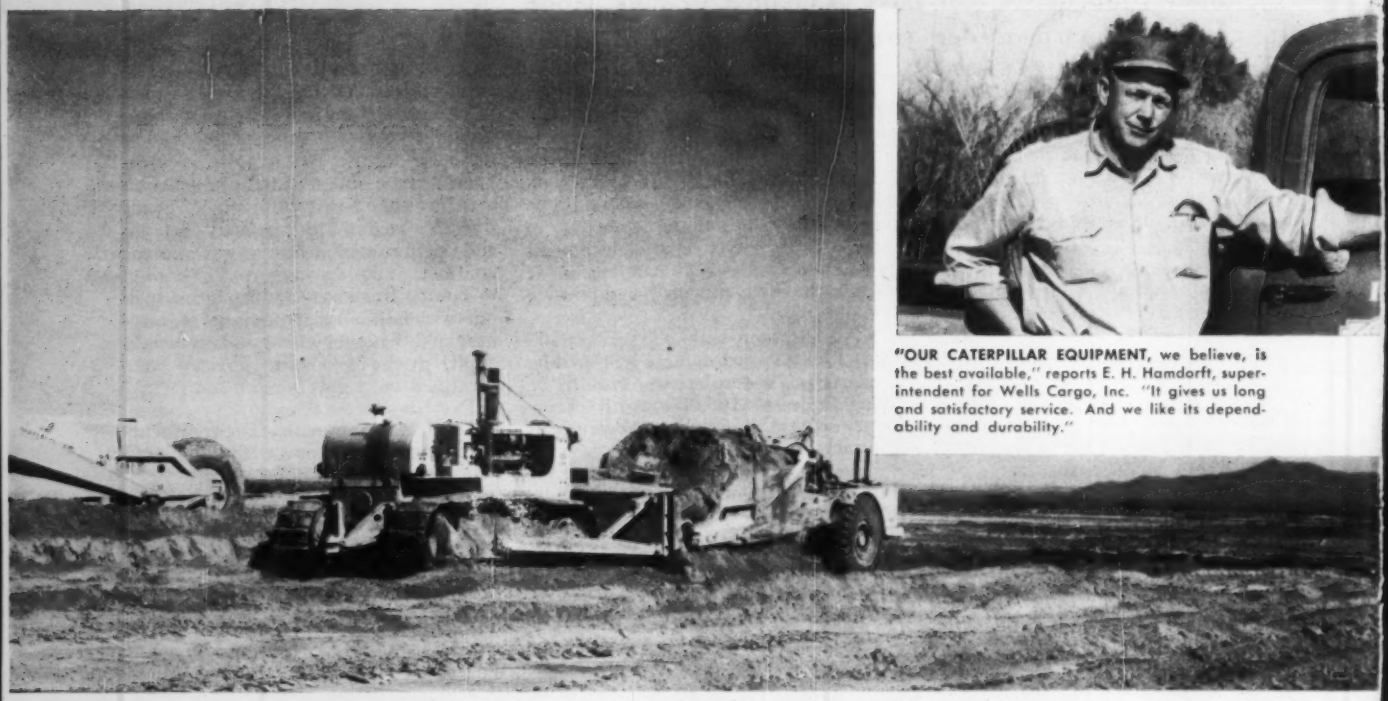
• The Associated General Contractors of Minnesota spells out in more detail what the other contractor groups seek to gain. The Minnesota group, made up of 188 general contractors who do "the bulk of construction work" in the state, urge "prompt adoption" of the proposed revisions.

Under present jurisdictional standards, says the Minnesota AGC, "90% state" does not qualify for NLRB to 95% of construction work in the handling. Only a project involving many millions of dollars can now qualify. "This is particularly disturbing, since it makes it extremely difficult to combat secondary boycotts."

In the absence of other comment from either employers or unions, the NLRB is bound to conclude the construction industry is generally in favor of the proposed changes affecting it. Nevertheless, many in the industry certainly have some of the doubts expressed by others—and shared by the board itself.

(*Continued on page 175*)

Loading time: 47 seconds on Picacho Reservoir job



"OUR CATERPILLAR EQUIPMENT, we believe, is the best available," reports E. H. Hamdorft, superintendent for Wells Cargo, Inc. "It gives us long and satisfactory service. And we like its dependability and durability."

WITH THE HELP OF A D9, DW21s are making 1,000-foot round-trip hauls in 2½ minutes.

Nine miles south of Coolidge, Ariz., Wells Cargo, Inc., of Las Vegas, Nev., is moving earth for the Picacho Reservoir. The job calls for moving 450,000 cu. yd. for the five miles of levee, and 40,000 yards for the core fill. To do this job on schedule, Wells Cargo is relying on a big Caterpillar fleet because of its "dependability and durability."

King of the fleet is the Cat D9 Tractor which, in addition to bulldozing, is pushloading five DW21s. By using the power of the D9 as a push-loader, Wells Cargo found that it cuts loading time by 43 seconds. It can get a heaping load in just 47 seconds, and make a 1,000-foot round trip in 2½ minutes.

This big tractor always pays its keep. Everywhere it is put to work, it cuts costs by stepping up production. Its 320 flywheel HP means fast production on any kind of big job. Built for long life under the most severe operating conditions, it combines the versatility and economy of diesel power with the power-boosting efficiency of a turbocharger. Despite its size, it responds quickly, surely and accurately. Hydraulic boosters provide power for steering, braking and master clutch use.

One of these giant tractors can be equipped to your own special needs by your Caterpillar Dealer. You can have the D9 with torque converter or direct drive with oil clutch. Why not see for yourself what it can do to step up production on *your* job? Ask your Caterpillar Dealer for a demonstration.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

THE D9 FOR HIGH PRODUCTION AND LOW UNIT COST ON BIG JOBS

• **Some problems**—Many firms outside the construction industry oppose expansion of NLRB jurisdiction because they think the no-man's area ought to be regulated by state agencies. Others—such as Small Business Administration chief Wendell Barnes—say the board can hardly hope to do real justice by taking on more cases. That's because the board already is far behind in deciding cases under its old, more narrow standards.

The Eisenhower board is sympathetic on both points. I would prefer the states to handle more cases now in the no-man's area. It adopted the restrictive 1954 jurisdictional rules with that in mind. And board members are seriously worried about being completely snowed under by too much work—even with additional money from Congress to cut down the backlog of old cases and handle its expanded jurisdiction.

But the board was forced to make a shift in the face of the Supreme Court's 1957 ruling in the Guss case. It said states cannot act in labor disputes affecting interestate commerce, even if NLRB declines to assert its jurisdiction over them. Congress can change this, said the court, or NLRB can reduce the no-man's area by exerting more of its jurisdiction.

Congress has refused to make any change, either to broaden or restrict NLRB's jurisdiction; and employer-union pressure has mounted for NLRB to give the protection Taft-Hartley provides.

The broadened jurisdictional standards, when actually put in operation by the board, will help relieve the situation and may delay Congressional consideration of new legislation on the matter.

But the resulting heavier case load on an already overburdened NLRB, coupled with the burning federal versus states' rights issue in labor relations, assures that this will not be a complete solution to the problem of the no-man's land.

Time Lost by Strikes Dipped to a July Low

The U. S. Labor Department reports that the man-days lost in July were 1.7 million. This is the lowest figure that has ever been recorded for any July since 1944.

The number of stoppages commenced during the month was 350. These affected 160,000 workers. Included among them are 25,000 construction workers idled by an operating engineers' strike in Oregon and southwest Washington.

Safety Efforts Get New Twist

Some 1,500 construction jobs in St. Louis were put to work last week as vehicles for safety promotion. Management and labor teamed up to stimulate safety consciousness under the slogan, "Work Safely, Mr. Building Tradesman!"

The slogan appeared on buttons worn by 30,000 construction workers in all segments of the industry and on posters tacked up on all construction jobs in the city. The posters, which set forth some of the more important safety rules, also were distributed in miniature throughout the greater St. Louis area.

Mayor Raymond R. Tucker officially designated the week as "Building Trades Safety Week."

The safety campaign was aimed at all levels of management, at every construction worker and at the general public. The message was this: Many construction operations are inherently dangerous. Individuals must protect themselves against the hazards. Accidents can be prevented. Cutting the accident toll is good business.

As some indication of the seriousness of the problem, Missouri contractors paid out $8 million last year in insurance premiums on construction accidents. About 40% of this was spent in St. Louis. Henry Till, manager of the St. Louis Associated General Contractors, says the insurance rates will go up about 2% on October 1 because of the industry's bad accident experience. This shows that the industry must be made more fully aware of the need for better accident prevention and the improvements a sound program can bring, Mr. Till says.

WORK SAFELY,
MR. BUILDING TRADESMAN!
Start by Learning These Rules
• Follow Them Always •
1. CLEAN JOBS ARE SAFE JOBS.
2. PROPERLY SET LADDERS ARE SAFE LADDERS.
3. TRENCHES CORRECTLY BRACED, AS NEEDED, ARE SAFE TRENCHES.
4. BLOCKED-UP EQUIPMENT IS SAFE EQUIPMENT.
5. UNGUARDED HOLES AND OPENINGS ARE MAN-TRAPS.
6. USE ONLY SOUND SCAFFOLDING BOARDS.
7. BE SURE ALL ELECTRIC POWER TOOLS ARE PROPERLY GROUNDED.
8. MOLES AND OWLS CAN SEE IN THE DARK. YOU NEED LIGHTS.
9. BE RESPECTFUL OF POWER LINES — STAY AWAY.
10. SHOW-OFFS, WISE GUYS AND PRACTICAL JOKERS CAUSE ACCIDENTS. BE SENSIBLE.
Building Trades Safety Week, Sept. 1-7, 1958
SPONSORED BY THE JOINT COOPERATIVE COMMITTEE
BUILDING & CONSTRUCTION TRADES COUNCIL — ASSOCIATED GENERAL CONTRACTORS OF ST. LOUIS

COLORFUL POSTERS herald Building Trades Safety Week in St. Louis.

The concerted effort to stimulate safety consciousness was sponsored by the Joint Cooperative Committee of the Building and Construction Trades Council (AFL-CIO) and the AGC of St. Louis. Purpose of the committee, which recently launched a cooperative effort to curb wasteful work practices, is to study problems affecting construction costs and to recommend improvements that will save owners and the public needless expense.

Trouble Shooters Are Wired for Sound

Business agents of the District Council of Carpenters in Philadelphia are carrying miniature radio receiving sets to keep in touch with union headquarters.

The primary purpose is to cut the time it takes to get an agent to a construction site where trouble is brewing or to respond to a contractor who asks for help. Complaints about work stoppages or calls for additional workers, for example, can receive attention in minutes instead of perhaps half a day.

The service has been in effect for a month. Council Secretary-Treasurer Robert H. Gray says it is "working out fine."

The transistor radio receivers are rented by the union from the Contact Radio Paging Division of Telephone Message Bureau. Light in weight and the size of a pack of cigarettes, the receivers are carried in the pockets of the agents. Once an hour the agents listen in and spot the messages directed to them by the code numbers used. The calls have a radius of 30 miles. Total cost to the union is $115.50 a month.

The council is the first big union group in the Greater Metropolitan Philadelphia area to use pocket radios for closer communication with its business agents.

The system was adopted over considerable opposition with the union. It was rejected initially by the business agents. Mr. Gray said their opposition was due to difficulty in understanding messages received and to the cost of the service. But it is understood from other sources that some of the agents felt the radio service would tie them down too much. Under the old system they called into headquarters only twice a day.

OFFICIAL PROPOSALS

RATE: The rate for Official Proposal advertising is $2.40 per line or fraction set solid. Where the advertisement is set other than solid, the space is measured by total space occupied and charged on basis of 12 lines to the inch.

CLOSING DATE: Friday 10:30 A.M. for issue dated the following Thursday.

SEND COPY TO: Official Proposal Division, Engineering News-Record Class. Adv. Div., P. O. Box 12, N. Y. 36, N. Y.

Prequalification Date: September 18, 1958

Board of Education
Bureau of Construction

Notice Re: Prequalification forms of Contractors

NOTICE IS HEREBY GIVEN THAT The Superintendent of School Buildings, Bureau of Construction, 4th Floor, Room 407, 42-15 Crescent Street, Long Island City 1, N.Y. will receive application for prequalification from contractors who may wish to submit bids for the proposed hereinafter specified contracts as follows:

General Construction, Plumbing and Drainage, Heating and Ventilating, Electrical Work and Lighting Fixtures for the new Junior High School 136, the Bronx, Prospect Avenue Ritter Place, Union Avenue and Jennings Street.

Prequalification application forms will have to be secured from and must be submitted to the Superintendent of School Buildings, Bureau of Construction, 4th Floor, Room 407, 42-15 Crescent Street, Long Island City 1, N.Y.

Bids when advertised, will be received from prequalified bidders only.

Time for submitting prequalification application by contractors will expire on Thursday, September 18th, 1958.

WILLIAM H. CORREALE
Superintendent of School Buildings,
Design and Construction

City Record—Monday, September 8th 1958

Dated: September 3rd 1958.

Bids: September 23, 1958

Contract BT-120.018

THE PORT OF NEW YORK AUTHORITY
PORT AUTHORITY BUS TERMINAL
ALTERATIONS FOR RETAIL STORE

Sealed proposals for the performance of interior alterations for a retail store in Room 1211 at the Port Authority Bus Terminal at 40th Street and Eighth Avenue, New York City, will be received at the office of the Chief Engineer of The Port of New York Authority, Room 1100, 111 Eighth Avenue, New York 11, N. Y. until 2:30 P.M. on Tuesday, September 23, 1958 at which time said proposals will be opened and read in Room 1108.

Contract Documents may be seen at the office of the Assistant Chief Engineer for Design of the Authority Room 1115 and copies will be furnished upon request. No deposit will be required but the documents shall be returned in good condition not later than forty days after the opening of proposals.

THE PORT OF NEW YORK AUTHORITY
Donald V. Lowe, Chairman
New York, September 11, 1958

Bids: September 16, 1958

Power Authority of the State of New York

ADVERTISEMENT FOR PROPOSALS
FOR
THE CONSTRUCTION OF SUBSTRUCTURES
FOR
THE AMERICAN RAPIDS BRIDGE AND APPROACHES AT NIAGARA FALLS, NIAGARA COUNTY, NEW YORK
SPECIFICATIONS NO. 5826 A
NIAGARA CONTRACT NO. N 14

NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the construction of the Substructures for the American Rapids Bridge and Approaches, Niagara Falls, New York until 10:30 a.m. Eastern Daylight Saving Time on the 16th day of September, 1958 at the Authority's Office, 18th Floor, The Coliseum Tower, 10 Columbus Circle, New York 19, New York, at which time and place the proposals will be publicly opened and read aloud.

The principal items of work are as follows:

Unclassified Excavation	3,200 cu. yds.
Selected Fill	6,000 cu. yds.
Portland Cement (Type II)	3,000 bbls.
Concrete	2,000 cu. yds.
Bar Reinforcement Steel	155,000 lbs.
Rubble Stone Masonry	100 cu. yds.

The work shall be completed on or before May 1, 1959.

Plans, Specifications and Proposal Forms for the work may be obtained from the Power Authority of the State of New York, at The Coliseum Tower, 18th Floor, 10 Columbus Circle, New York 19, New York, upon application and prepayment of a fee of Ten ($10.00) dollars per initial set of contract documents, and five ($5.00) dollars per set for additional sets, no part of which shall be refunded. Plans, Specifications and Proposal Forms for the work will be on file in the Authority's New York Office, and at the Authority's Field Office, 2640 Main Street, Niagara Falls, New York and in the offices of the Engineer, Praeger-Kavanagh, 126 East 38th Street, New York 16, New York, and may be inspected by prospective bidders during office hours.

Bids must be made in accordance with the instructions contained in the Information for Bidders. Guarantee will be required with each bid in an amount not less than 20 per cent of the gross sum price bid.

The right is reserved to reject any or all bids.

W. S. CHAPIN
GENERAL MANAGER

Bids: September 30, 1958

Power Authority of the State of New York

ADVERTISEMENT FOR PROPOSALS
For the Furnishing and Delivery of Gantry Cranes and Traveling Cranes for Lewiston Power Plant
Niagara Power Project
Specifications No. PA-N-24010
Niagara Contract No. NP16

NOTICE TO CONTRACTOR: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the furnishing and delivery thereof f.o.b. University Siding, Lewiston Power Plant Area, New York, of the gantry cranes and traveling cranes for the Lewiston Power Plant in Lewiston, Niagara County, New York, until 10:30 A.M., Eastern Daylight Saving Time, on the 30th day of September, 1958, at the Authority's Office, 18th Floor, The Coliseum Tower, 10 Columbus Circle, New York 19, New York, at which time and place proposals will be publicly opened and read aloud.

Bids will be received for one 630 Ton, one 100 Ton and one 30 Ton gantry crane, one 150 Ton, and two 7½ Ton traveling cranes and associated equipment.

Delivery of the equipment will be required beginning October 1, 1959.

Plans, Specifications and Proposal forms for the work, may be obtained from the Power Authority of the State of New York, at 18th floor, The Coliseum Tower, 10 Columbus Circle, New York 19, New York, upon application and prepayment of a fee of Ten Dollars ($10.00) per initial set of contract documents, and Five Dollars ($5.00) per set for additional sets, no part of which will be refunded. Plans, Specifications and Proposal forms for the work will be on file in the Authority's Office and in the offices of the Engineer, Uhl, Hall & Rich, 230 Congress Street, Boston 10, Massachusetts, and may be inspected by prospective bidders during office hours.

Bids must be made in duplicate in accordance with instructions contained in the Information for Bidders. Guarantee will be required with each bid in an amount not less than 20 percent of the gross sum bid for that schedule which has the highest gross sum bid.

The right is reserved to reject any or all bids.

W. S. Chapin
General Manager

U. S. Government

Department of Commerce, Civil Aeronautics Administration. Sealed bids (Invitation No. 9-3158B1) will be received at Washington, D. C., until 2:00 P.M., Wednesday, September 24, 1958, for grading and drainage work in connection with the development of the Washington International Airport in Fairfax and Loudoun Counties, Virginia, involving an area of approximately 3,000 acres, including excavation and embankment, maintenance of existing roads, sewers, culverts and drainage structures and other related work. For particulars address Procurement Division, W-160, Civil Aeronautics Administration, T-5 Building, Room 2615, Washington 25, D. C. A $25.00 deposit per set must accompany requests for plans and specifications.

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Specifications No. DC-5104) will be received at Grand Junction, Colorado until 10 a.m. Mountain Standard Time, October 7, 1958, for furnishing labor and materials for Southside Tunnel, Collbran Project, Colorado. Location near Collbran, Colorado, in Mesa County. Principal items are 4,500 cu. yds. open cut excavation; 4,900 cu. yds. excavation in tunnel; 1,850 cu. yds. concrete in tunnel lining; and other work. Completion time 560 days. For particulars, address Bureau of Reclamation, P. O. Box 780, Grand Junction, Colorado; or Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

Department of Commerce, Bureau of Public Roads, September 9, 1958. SEALED BIDS will be received at the office of the Regional Engineer, Bureau of Public Roads, 1440 Columbia Pike, Arlington, Virginia, until 11:00 a.m., D.S.T., OCTOBER 9, 1958, for Contract 6, West and East Approach Superstructure Steelwork, Woodrow Wilson Memorial Bridge over the Potomac River. The west approach consists of 22 spans having a total length of 1,685 feet, all over land and located in the City of Alexandria, Virginia. The east approach consists of 27 spans having a total length of 2,722 feet, all over the shallow portion of the river and located in Prince Georges County, Maryland. The approximate quantity of the principal items is 12,800,000 lb. of structural carbon steel. Minimum wage rates have been fixed as required by law. Plans, specifications and proposal forms are available upon request at the address given above. A. F. Ghiglione, Regional Engineer.

Department of Commerce, Bureau of Public Roads, September 9, 1958. SEALED BIDS will be received at the Office of the Regional Engineer, Bureau of Public Roads, 1440 Columbia Pike, Arlington, Virginia, until 11:00 a.m., D.S.T., OCTOBER 9, 1958, for Contract 4, West Approach Substructure and Contract 5, East Approach Substructure, Woodrow Wilson Memorial Bridge over the Potomac River. The construction under Contract 4 consists of twenty-one land piers, an abutment, two retaining walls each about 425 feet long, and the relocation of an existing street involving minor items of roadway paving, curbs, sidewalk, drainage structures, etc., all located in the City of Alexandria, Virginia. The approximate quantities of the more important items for Contract 4 are 16,600 lin. ft. of Concrete Piles, 5,000 cu. yd. of Concrete and 400,000 lb. of Reinforcement Steel. The construction under Contract 5 consists of twenty-six piers in the shallow water of the river and one abutment on Rosalie Island, all located in Prince Georges County, Maryland. The approximate quantities of the more important items for Contract 5 are 62,400 lin. ft. of Concrete Piles, 10,675 cu. yd. of Concrete, and 770,000 lb. of Reinforcement Steel. Bidders may bid for Contract 4 only, for Contract 5 only, separately for Contracts 4 and 5 as exclusive bids for which the bidder is willing to accept award of either one but not both, or for Contract 4 and 5 jointly if willing to accept award of both. Minimum wage rates have been fixed as required by law. Plans, specifications and proposal forms are available upon request at the address given above. A. F. Ghiglione, Regional Engineer.

OFFICIAL PROPOSALS

Bids: September 18, 1958

New York State Road Work

NOTICE TO CONTRACTORS: STATE DEPARTMENT OF PUBLIC WORKS, ALBANY, N. Y.—Pursuant to the provisions of the Highway Law, Canal Law, and special provisions for projects financed with Federal Aid Funds, sealed proposals will be received until ten-thirty o'clock A.M., advanced standard time, which is nine-thirty o'clock A.M., eastern standard time, on the 18th day of September, 1958, by Henry A. Cohen, Director, Bureau of Contracts, 12th Floor, The Governor Alfred E. Smith State Office Building, Albany, N. Y., for the following Projects:

County	Contract No.	Name	Miles	Type	Deposit	Estimated Cost of Work
DISTRICT No. 1, G. L. Nickerson, District Engineer, 353 Broadway, Albany 1, New York						
Essex (Rte. 73)	RC 58-121	Village of Lake Placid: Sentinel Road, S.H. 9319	0.07	Asphalt Concrete Prestressed Conc. Br. 34′	$6,000 Plans $2	$110,000
Saratoga (Rte. 67)	FARC 58-131	Ballston Spa Scotch Church Pts. 1 & 2, S.H. 5534-5542 Project DS 382(2)	5.21	Asph. Conc. = 5.15 Mi. Misc. Work = 0.06 Mi. Reinf. Conc. Box Br. 20′	$50,000 Plans $5	892,000
Warren (Rte. 9 & 9L)	RC 58-135	Various Locations on S.H. 417, S.H. 5068, S.H. 5227, S.H. 5157, S.H. 5158, S.H. 1595, S.H. 691, and S.H. 1666	....	Roadside Development	$700 Plans $2	13,000
Washington (Rte. 40)	FARC 58-127	Middle Falls South Argyle, S.H. 1759 South Argyle-Argyle, S.H. 1681 Project DF 1033(2)	5.89	Asph. Conc. = 5.83 Mi. Misc. Work = 0.06 Mi.	$54,000 Plans $3	988,000
DISTRICT No. 2, L. Ketchum, District Engineer, 109 No. Genesee Street, Utica 1, New York						
Montgomery (Rte. 30)	FAC 58-16	City of Amsterdam: North-South Arterial (Rte 55 to Mohawk River) Project U-UG-604(5)	0.63 (1.34 Acc.)	Asph. Conc. Ty. 1A = 0.63 Mi. Acc. Asph. Conc. Pavt. = 1.11 Mi. Acc. Cem. Conc. Pavt. = 0.23 Mi. 2 Hy. Sepa. Comp. W-F Beams 166.4′ & 171.5′ 1 Hy. Sep. Reinf. Conc. Rigid Frame 36′ 1 Hy. RR Sep. Comp. W-F Beam 169.2′	$115,000 Plans $10	2,054,000
DISTRICT No. 3, E. E. Towlson, Acting District Engineer, 333 E. Washington Street, Syracuse, New York						
Cayuga (Rte. 38)	FARC 58-128	Wyckoff Cascade Pt. 3, S.H. 8267 Cascade Moravia, S.H. 1642 Project F 431(4)	4.13	Asphalt Concrete Prestressed Conc. Beam Br. 172′	$52,000 Plans $3	944,000
Oswego	U.S. 100	Lock 3, Oswego Canal, Fulton, New York	....	Extending Existing Gates, Lowering & Replacing Existing Sills & Misc. Work	5% of Bid Plans $10	Confidential
Cayuga & Tompkins (Rtes. 38, 326, 34B, 38A, 90, 79, 13, 227, 13A, 34, 327, & 96B)	RC 58-126	Various Locations on S.H. 752, S.H. 1173, S.H. 5689, S.H. 5525, S.H. 383, S.H. 8406, S.H. 1877, S.H. 1004, S.H. 338, S.H. 483, S.H. 1001, S.H. 1431, S.H. 1532, S.H. 72, S.H. 681, S.H. 5575, S.H. 1891, S.H. 5567, S.H. 1189, and S.H. 5122	....	Roadside Development	$500 Proposal Only $2	9,000
Cortland & Tompkins (Rte. 222)	FARC 58-124	Cortland Groton Pts. 1, 2, 3 & 4, S.H. 446, 996, 1433 Project S 478(1)	5.46	Asphalt Concrete, Type 1A Comp. I Beam 132′	$53,000 Plans $3	949,000
Onondaga	RC 58-136	Baldwinsville Cicero, S.H. 1039	....	Cleaning & Painting 1 Bridge	$500 Plans $2	9,000
Onondaga	FASS 58-10	Brewerton Connection to Interstate Route 505 Project S 538(1)	0.45	Asphalt Concrete	$5,000 Plans $2	88,000
Seneca (Rte. 96A)	FARC 58-122	Lodi Interlaken, S.H. 5589 Project DS 463(1)	4.99	Asphalt Concrete	$30,000 Plans $3	592,000
DISTRICT No. 4, B. F. Perry, District Engineer, Barge Canal Terminal, Rochester 1, New York						
Genesee & Wyoming	FASSH 58-10 FASSH 58-11	Attica Darien Pt. 2 Attica Darien Pt. 1 Project S 495(1)	4.17	Asphalt Concrete	$30,000 Plans $3	573,000
Monroe	LOSP 58-2	Lake Ontario State Parkway, (Sections A and B)	9.17	Asph. Conc. = 7.34 Mi. Misc. Work = 1.83 Mi.	$55,000 Plans $10	1,001,000
DISTRICT No. 5, E. G. H. Youngmann, District Engineer, State Office Bldg., 65 Court Street, Buffalo, New York						
Erie	FAC 58-19	City of Buffalo: Kensington Expressway Arterial Highway, Sect. 1 (Maple St. to Landon St.) Project U 377(16)	1.69	Grading & Trunk Sewer = 1.15 Mi. Trunk Sewer = 0.24 Mi. Water Lines = 0.30 Mi.	$170,000 Plans $10	3,081,000
Erie	FAC 58-17	City of Buffalo: Kensington Expressway Outlet Sewer (Swan St. to Hickory St.) Project U 377(15)	1.10	9′ Reinf. Conc. Pipe Sewer = 0.83 Mi. 8′ Reinf. Conc. Pipe Sewer = 0.25 Mi. Misc. Work = 0.02 Mi.	$120,000 Plans $3	2,180,000
Erie (Rte. 422)	FARC 58-133	Jamison East Elma, S.H. 925 Project DS 409(2)	4.93	Asph. Conc. = 4.90 Mi. Misc. Work = 0.03 Mi.	$40,000 Plans $3	734,000
(Niagara (Rte. 31)	FARC 58-108	Niagara Falls Sanborn, S.H. 5305 Sanborn Pekin, S.H. 740 Project DF 1088(2)	6.50	Asph. Conc. = 6.46 Mi. Misc. Work = 0.04 Mi.	$43,000 Plans $2	774,000
DISTRICT No. 6, J. H. Thomas, District Engineer, State Office Building, 30 West Main Street, Hornell, New York						
Steuben (Rte. 225)	FARC 58-123	Caton Corning, S.H. 850 Project DS 734(2)	0.10	Asphalt Concrete	$3,000 Plans $2	52,000
DISTRICT No. 7, R. W. Sweet, District Engineer, 444 Van Duzee Street, Watertown, New York						
Clinton	FISH 58-25	Interstate Route 502, Sect. 7D-2 (Ridge Road to Canadian Border) Project I-1119(12)	2.57 (4.50 Acc.)	Asph. Conc. = 6.99 Mi. Top Crse. Graded Gravel = 0.06 Mi. Misc. Work = 0.02 Mi. 1 Hy. RR Sep. Comp. I Beam 458.5′ 2 Hy. Seps. Comp. I Beam 314.8′ & 214.5 1 Br. Comp. I Beam 270′	$250,000 Plans $20	4,563,000
Franklin (Rte. 37)	FARC 58-134	Malone Fort Covington Pt. 1, S.H. 884 Project DF 580(13)	2.25	Asph. Conc. = 2.19 Mi. Misc. Work = 0.06 Mi.	$23,000 Plans $3	413,000
Jefferson (Rte. 177)	FARC 58-129	Adams Center Tremaines Corners, S.H. 835 Tremaines Corners Barnes Corners Worth Corners, S.H. 1751 Project F 864(4)	5.53	Asphalt Concrete Comp. I Beam Br. 84.3′ Reinf. Conc. Open Box Br. 28.3′	$80,000 Plans $10	1,559,000
DISTRICT No. 8, K. G. Rauer, District Engineer, Pleasant Valley Road, Poughkeepsie, New York						
Orange (Rte. 6)	FARC 58-132	Middletown Goshen, S.H. 95 New Jersey State Line Unionville New Hampton Denton, S.H. 500 Project DF 345(4)	0.93	Asphalt Concrete	$22,000 Plans $2	388,000
Orange (Rte 9W)	RC 58-60	West Point Military Reservation Cornwall Pt. 1, S.H. 8500	0.18	Asphalt Concrete	$3,000 Plans $2	51,000
Putnam (Rte. 6)	FARC 58-120	Brewster Carmel, S.H. 909 Project DF 590(5)	1.43	Asphalt Concrete	$15,000 Plans $2	273,000
Putnam (Rte. 6)	FGRC 58-24	Brewster Carmel, S.H. 909 Project DFG 590(3)	0.14	9″ Cem. Conc. Pavt. 24′ Wide R.R. Hy. Sep. Pl. Girder 103.6′	$19,000 Plans $2	349,000
Westchester	FINET 58-3 NET 58-4	Interstate Route 501 (N. Y. State Thruway, New England Section, Subs. 1, 2A, 2, 3, 4 and 5) and New York State Thruway—New England Section Project I 1068(19)	11.31	Lighting System	$55,000 Plans $3	963,000
DISTRICT No. 9, J. C. Frederick, District Engineer, 71 Frederick Street, Binghamton, New York						
Broome	FISH 58-7	Interstate Route 505, Penn. State Line to Five Mile Point Cont. No. 1 (Penn. St. Line to Blakesley Rd.) Project I 1127(5)	3.04 (0.60 Acc.)	Grading & Drainage 6 Hy. Seps. Comp. I Beams 137.4′, 127.1′; 187.5′; 192.3′; 141′ & 141′ 1 Reinf. Conc. Box Br. 20.8′	$165,000 Plans $20	2,819,000
Chenango (Rte. 12)	FAC 58-18	City of Norwich: Arterial Highway (South and North Broad St.) Project U 878(3)	1.02	Asph. Conc. Ty. 2B = 1.01 Mi. Misc. Work = 0.01 Mi.	$40,000 Plans $3	733,000
Sullivan (Rte. 97)	FARC 58-125	Mongaup Pond Eddy, S.H. 1483 Pond Eddy Barryville, S.H. 8352 Project DF 502(16)	6.66	Asphalt Concrete Widen Exist. 46′ Reinf. Conc. Beam Br.	$62,000 Plans $5	1,137,000
DISTRICT No. 10, M. E. Goul, District Engineer, 325 W. Main Street, Babylon, L. I., New York						
Nassau (Rte. 27, 115)	FARC 58-130	Conduit Boulevard Pts. 3, 4, & 5, S.H. 1699A, 1699B, 5701A Wantagh Central Park Pt. 1, S.H. 1798 Project U 947(16)	4.04	1½ 9″ Cem. Conc. Pavt. } = 2.93 Mi. 1½ Asph. Conc. } 9″ Cem. Conc. Pavt. = 0.09 Mi. Asph. Conc. = 0.50 Mi. Misc. Work = 0.52 Mi.	$195,000 Plans $5	3,547,000

(Continued on the following page)

OFFICIAL PROPOSALS

(Continued from page 177)

Any projects in this letting that are on the Federal Aid highway systems are subject to the provisions of the "Federal-Aid Highway Act of 1956", being Public Law 627, 84th Congress, approved June 29, 1956, and are also subject to the applicable New York State statutes.

In compliance with the provisions of Section 115 (Prevailing Rate of Wage) Public Law 627, the minimum wages to be paid laborers and mechanics are included in wage schedules that are set out in the bid proposal.

Maps, plans, specifications and proposal forms may be seen and obtained at the office of the State Department of Public Works, Bureau of Contracts, Albany, N. Y., and at the office of the District Engineers noted above, and may also be seen at the office of the State Department of Public Works, 270 Broadway, New York City.

The deposit for Plans and Proposal Forms for each contract is indicated above. A refund will be made in full to bidders for return of one set, in good condition, within 30 days of award, or rejection of bids; refund for all other sets in good condition, similar period, will be 50% of deposit.

Special attention of bidders is called to "Information for Bidders" in the Public Works Specifications, and to the special provisions applying to projects financed with federal funds. Award of a contract is subject to priorities and allocations under the Defense Production Act of 1950, as amended, and all regulations issued thereunder.

Proposal for each contract must be submitted in a separate sealed envelope with the name and number of the contract plainly endorsed on the outside of the envelope. Each proposal must be accompanied by draft or certified check payable to the order of the "State of New York, Commissioner of Taxation and Finance" for the sum as specified in the advertisement and the proposal. The retention and disposal of the bidding check, the execution of the contract and bonds shall conform to the provisions of the Highway Laws, as set forth in "Information for Bidders".

The right is reserved to reject any or all bids.

JOHN W. JOHNSON
SUPT. OF PUBLIC WORKS

Bids: September 25, 1958.

Power Authority of the State of New York

ADVERTISEMENT FOR PROPOSALS
For the Furnishing and Delivery of
High Voltage Disconnecting Switches for
Niagara Switchyard
Niagara Power Project
Specifications No. PA-N-25017
Niagara Contract No. NP21

NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the furnishing and delivery thereof f.o.b. Niagara Switchyard Area, University Siding, Niagara Falls, New York, of 115 kv and 230 kv disconnecting switches for the Niagara Switchyard in Lewiston, Niagara County, New York, until 10:30 A.M. Eastern Daylight Saving Time on the 25th day of September, 958, at the Authority's Office, 18th Floor, The Coliseum Tower, 10 Columbus Circle, New York 19, New York, at which time and place proposals will be publicly opened and read aloud.

Bids will be received for 139, 78 or 61 high voltage disconnecting switches and associated equipment in accordance with the bidding schedules.

Delivery of the high voltage disconnecting switches will be required beginning on or before September 30, 1959.

Plans, Specifications and Proposal Forms for the work may be obtained from the Power Authority of the State of New York, 18th Floor, The Coliseum Tower, 10 Columbus Circle, New York 19, New York upon application and prepayment of a fee of Ten Dollars ($10.00) per initial set of contract documents, and Five Dollars ($5.00) per set for additional sets, no part of which will be refunded. Plans, Specifications and Proposal Forms for the work will be on file in the Authority's Office and in the offices of the Engineer, Uhl, Hall & Rich, 230 Congress Street, Boston 10, Massachusetts, and may be inspected by prospective bidders during office hours.

Bids must be made and returned in duplicate in accordance with instructions contained in the Information for Bidders. Guarantee will be required with each bid in an amount not less than 20 percent of the gross sum bid for any bid schedule.

The right is reserved to reject any or all bids.

W. S. Chapin
General Manager

OFFICIAL PROPOSALS

Bids: October 21, 1958

Algonquin Avenue Outlet Sewer

DEPARTMENT OF PUBLIC WORKS
CITY OF DETROIT, MICHIGAN
CONTRACT PW-2106

Sealed proposals for a sewer located in Freud, Algonquin, and Kercheval Avenues from Freud Pumping Station to the junction chamber at Manistique and Kercheval, will be received at the Office of the City Engineer, 528 City-County Building, Detroit 26, Michigan, until 2:00 P.M., Detroit Time, October 21, 1958, and then at such place and time publicly opened and read aloud.

The work consists of approximately 1.45 miles of 16'-0" inside diameter concrete sewer in Freud, Algonquin, and Kercheval Avenues, approximately 300 feet each of 10'-0" and 11'-6" inside diameter concrete sewer, and 0.24 miles of 12'-6" inside diameter sewer, all built in tunnel. Included in the Contract is a porthole connection and two reinforced concrete transition chambers. The Bidding Documents may be examined at the Office of the City Engineer during business hours, and copies may be obtained upon deposit of $25.00 per set, which deposit will be refunded upon the return of the Bidding Documents in good condition within 10 days after the date for opening of bids.

Each proposal must be accompanied by a certified check, bank draft, or a satisfactory surety bid bond in an amount not less than 5 percent of the total bid price as guarantee and security for acceptance of the Contract. Checks shall be made payable to the Treasurer, City of Detroit.

No proposal once submitted may be withdrawn for at least 45 days after the actual opening of the bids. The City of Detroit reserves the right to waive any irregularity in any bid, or to reject any or all bids, should it be deemed for its best interest.

CITY OF DETROIT
GLENN C. RICHARDS
Commissioner of Public Works

M. F. WAGNITZ
City Engineer

OFFICIAL PROPOSALS

EMPLOYMENT NATIONAL COVERAGE OPPORTUNITIES

DISPLAYED RATE:

The advertising rate is $39.20 per inch for all advertising appearing on other than a contract basis. Frequency rates quoted on request.

An advertising inch is measured 7/8" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

SEPT. 25TH ISSUE CLOSES SEPT. 15TH

UNDISPLAYED RATE:

$2.40 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Position Wanted ads take ½ of above rate.

Box numbers—count as 1 line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

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• POSITIONS VACANT

Highway Engineers—Highway Engineers with a minimum of 3 years experience. Excellent opportunity with established consulting engineering firm in Middle West. P-7909, Engineering News-Record.

Engineer-Management. Associate with legal and/or accounting training—development and construction of oil company terminal projects—New York and East Coast areas. P-8716, Engineering News-Record.

Wanted: Top Flight Salesman-Estimator for aggressive, growing steel fabricator. Must know structural steel and construction business. Opportunity for ambitious man to grow with company. Location Michigan. P-8769, Engineering News-Record.

Wanted: General Building Construction Estimator, experienced in concrete, masonry and building trades. Position with expanding established general contractor in New York-Westchester area. P-8768, Engineering News-Record.

Estimator: General Contractor, location— Allentown, Bethlehem area, Pennsylvania. Must have take-off experience on all types of industrial and commercial buildings. Reply giving name, address, age, education, experience and salary desired. P-8760, Engineering News-Record.

Civil or Arch. Engineering Graduates under 30, aggressive, military completed. For estimating and field engineering. Some background experience desirable. Submit personal resume and recent photograph. Dondlinger & Sons Const. Co., Inc., Box 398, Wichita, Kansas.

Resident Engineer, experienced, registered, on small sewage treatment project, (about $250,000), salary range $500 to $600 per month depending on qualifications, plus reasonable expense allowance. Complete resume of experience and education and statement of salary requirement in letter of application. Location Ohio. P-8785, Engineering News-Record.

Superintendent Wanted for road construction. Rieth-Riley Construction Co., Inc., P.O. Box 477, Goshen, Indiana.

Graduate engineers experienced in soils and building materials testing. Thompson & Lichtner Co., 8 Alton Place, Brookline 46, Mass.

Bridge Designers with Interstate experience. Forward complete resume of education and experience with salary requirements to Macomber & Faber, 1824 N. 4th St., Harrisburg, Pa.

Associate Civil Engineers San Francisco Bay Area—$625-$780. Design positions in street and port departments. Promotional opportunities, liberal benefits. B.S. in civil and 3 years experience. Contact Mr. Weaver, Civil Service, Room 100, City Hall, Oakland, California.

Civil Engineer with extensive experience in the design and construction of large capacity water supply projects including pumping stations and intake structures. Send complete resume including salary requirements. P-8804, Engineering News-Record.

Engineer—Wanted by New York State Department of Civil Service to prepare and rate engineering examinations. Vacancies exist for Senior Engineering Examiner $6140 to $7490 and Associate Engineering Examiner $7500 to $9090. Nation-wide written tests on November 8 for qualified citizens of the United States. If eligible candidates may compete in both tests. Candidates must have a B.S. degree in Civil Engineering and two years of experience in professional engineering, or preparing and rating engineering examinations or teaching engineering subjects in a recognized college, or a combination of the above. For the Associate position candidates must have one additional year of the above experience and a New York State professional engineer's license. Non-residents of the State must have a professional engineer's license recognized as equivalent to the New York State license from the state or territory of the United States in which they live or have place of business. For detailed announcements and application blanks write to Box 19A, Recruitment Unit, New York State Department of Civil Service, State Campus, Albany 1, N. Y.

(Continued on page 180)

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to expedite the handling of your correspondence and avoid confusion, please do not address a single reply to more than one individual box number. Be sure to address separate replies for each advertisement.

ENGINEERS

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PREFER GRADUATE REGISTERED ENGINEERS WHO SEEK LONG RANGE EMPLOYMENT WITH AMPLE OPPORTUNITY FOR PROFESSIONAL DEVELOPMENT AND ADVANCEMENT IN A STEADILY EXPANDING AND GROWING ORGANIZATION.

Paid vacation, sick leave, holiday, overtime. Excellent Employee Benefits Plan provides retirement income plus life and disability insurance. Blue Cross. Moving allowance.

Work will be in the general offices in St. Louis. Interviews can be arranged in Washington, D. C., and San Francisco also.

Please write fully, including salary data, to

SVERDRUP & PARCEL, Inc.
ENGINEERS — ARCHITECTS
915 Olive St. Louis 1, Mo.

ENGINEERING DESIGN PERSONNEL

For Work On Highway, Bridge, Water and Sewerage Projects
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Career opportunities for individuals interested in professional recognition, ample opportunity for advancement based on merit, plus employee retirement plan, group life insurance, hospitalization, paid vacation and holidays.

Mail Resume To F. W. AHERN, Personnel Director

MICHAEL BAKER, JR., INC.
Consulting Engineers
Baker Building Phone SPruce 4-3010 Rochester, Penna.

HIGHWAY and BRIDGE CONSTRUCTION ENGINEERS

for work in SOUTHEAST ASIA

Senior personnel needed to complete technical party. Work involves supervision of construction of highways and bridges in South Vietnam. Duties include instruction of on-the-job trainees. High degree of initiative, judgment and skill in handling human relations required in addition to professional competence. Eighteen-month minimum employment agreement. Only those interested in difficult and challenging work should apply.

Minimum 20 years experience on construction supervision of highways and/or bridges required in these highly responsible positions. Age limit 65 years. Those willing to travel in single status will be given preference.

For Application Blank Write to

CAPITOL ENGINEERING CORPORATION
Consulting Engineers DILLSBURG, PENNSYLVANIA

OVERSEAS OPPORTUNITIES FOR

DESIGN ENGINEERS

DAMS DESIGN ENGINEER—with minimum five years responsible experience in design of large concrete dams, preferably of arch type, including detailed design of block monoliths.

CIVIL-STRUCTURAL DESIGN ENGINEER—with about ten years experience in design of hydroelectric powerhouses, spillways, outlet works, etc.

CIVIL-HYDRAULIC DESIGN ENGINEER—with five to ten years experience on hydraulic design, including hydraulic model testing for major dams, spillways, outlet works, etc.

MECHANICAL DESIGN ENGINEER—with five to ten years experience in detailed mechanical design of hydroelectric power-plant auxiliaries.

* * *

Family status assignments, new housing, allowances, privileges, minimum 16-month contracts. High salaries commensurate with experience and ability.

Send complete details of education, experience and past earnings to:

P-8831, Engineering News-Record
Class. Adv. Div., P. O. Box 12, N. Y. 36, N. Y.

GRADUATE CIVIL or ARCHITECTURAL ENGINEERS

We are looking for a young, recent college graduate, with a degree in either architectural or civil engineering, for a position in our El Paso, Texas—Estimating Department. This position provides a training ground for our future superintendents and executives. It is an excellent opportunity for a young man to obtain a desirable position with a reliable firm doing all types of construction work.

ROBERT E. McKEE
GENERAL CONTRACTOR, INC.
PO BOX 562 EL PASO, TEXAS

EXECUTIVE

To associate with an established consulting engineering firm for the direction of their Sanitary, Water Supply and Sewage work. This man must be a registered C.E., with 20 years experience in sanitary engineering, and prominent in this field. Important among his duties will be negotiating for new business and the direction of an engineering staff for the production of contract plans. All replies confidential.

P-8820, Engineering News-Record
Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

CIVIL ENGINEERS
HIGHWAY DESIGNERS
STRUCTURAL DESIGNERS
DRAINAGE DESIGNERS
FOR HIGHWAY and BRIDGE WORK
SENIOR and JUNIORS
WORK IN RICHMOND, VA.
Send Resumes to
Blackburn & Blauvelt
3114 West Clay Street Richmond, Va.

EMPLOYMENT PROBLEM?

When you are in need of specialized men for specialized jobs, contact them through an employment ad in this publication.

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STRUCTURAL ENGINEER

Structural steel designer and estimator for industrial buildings and miscellaneous steel structures. Applicant should be graduate engineer, preferably 30-40 years old, with minimum of 5 years actual structural steel design experience. Permanent employment, paid vacations, group insurance plan, pension plan. Excellent opportunity. Location Mid-West. Employer is nationally known, well established steel fabricator.

Reply fully, giving resume of experience, education, age and salary requirements to

P-8715, Engineering News-Record
520 N. Michigan Ave., Chicago 11, Ill.

• POSITIONS VACANT

(Continued from page 178)

Reinforcing Detailer with a minimum of five years experience. Excellent starting salary and usual benefits. Opportunity for advancement. Brocker Mfg. & Supply Co., York, Pennsylvania.

Graduate Civil or Sanitary Engineer experienced in design of sewage and water treatment plants and related facilities. Excellent opportunity with growing firm located in Mid-South. Replies confidential. P-8811, Engineering News-Record.

Estimator, Electrical—Excellent opportunity for right man thoroughly familiar with heavy electrical construction. College degree desirable, but not compulsory. P-8822, Engineering News-Record.

Civil Engineer, graduate, with some street and sewer layout and/or structures experience, preferred but not required, as assistant to City Engineer in Pennsylvania. City of 20,000 population with up-to-date municipal utilities, including activated sludge sewage treatment plant, water works, modern incinerator. Clean college city with good government. Salary commensurate with education and experience. Send complete resume in first letter to P-8823, Engineering News-Record.

Qualified Reinforcing Steel Estimator required for growing Fabricator. Excellent salary for right man. Brocker Mfg. & Supply Co., York, Pennsylvania.

Aggressive Civil Engineer—Age 24 to 30— General Construction estimator with some construction experience—Industrial, commercial, institutional—Opportunities and benefits—Location South East Ohio—Send resume. P-8834, Engineering News-Record.

• POSITIONS WANTED

General Superintendent, 46, Broad experience in building construction, presently employed—interested in change. Thoroughly qualified and responsible at management level. PW-8663, Engineering News-Record.

Teaching Position with a university in U.S.A. or Canada, desired by Professional Civil Engineer, B.Eng., Master of Eng. in Soil Mechanics, thoroughly experienced in Soil Mechanics and Foundation, Highways, Airforce Bases and Bridges. Presently employed as Project Manager. PW-8719, Engineering News-Record.

Sewer Grading Paving foreman, 20 years experience available immediately. Will relocate. PW-8764, Engineering News-Record.

BSCE-MIT, PhD Rome Italy, US citizen, experience on both sides Atlantic. Would like to remain in Europe. Write Engineer, Vle XXI Aprile 34, Rome, Italy.

Contractor's Sup't. or Engineer. 17 yrs. grade drain pave, & structures. B.S.C.E. Estimating & management experience. PW-8753, Engineering News-Record.

BSCE Assoc., LDS, 25, 3 yrs. Varied design and super., USA or foreign. PW-8803, Engineering News-Record.

Executive, Construction, A.M.ASCE, 38, English education, 18 years experience residentiall, commercial, industrial, slipform, feedmill, all phases, preliminary design to completion, foreign and domestic. Has been vice-president and president. Internationally travelled. Seeks responsible position, Hawaii, Puerto Rico, California, Florida. PW-8800, Engineering News-Record.

Professional Engineer, sewer designing, supervising, and planning. PW-8813, Engineering News-Record.

Superintendent; Contractor's Assistant. BSCE; registered P.E.; Age 34. Seven years of commercial and industrial building construction experience. Desire permanent, responsible position in Southern California. PW-8814, Engineering News-Record.

Sewer foreman, 25 years of experience, can handle masterly and profitably the most difficult sewer job; is seeking permanent position with judicious contractor. Salary or profit sharing plan. PW-8815, Engineering News-Record.

Const. Supt.; 20 years institutional, Industrial, Commercial. Engineer. Anywhere. PW-8829, Engineering News-Record.

Civil Engineer—MSCE in hydraulics and fluid mechanics. Junior Member ASCE. Veteran. Permanent employment desired. PW-8824, Engineering News-Record.

• POSITIONS WANTED

Municipal Engineer, top qualifications, seeks position as City Engineer in growing progressive community. Consider similar responsibility with consultant. PW-8826, Engineering News-Record.

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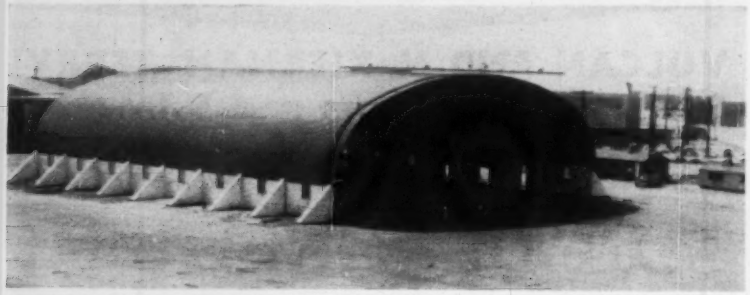

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Editorials

Politics and Highways

A HIGHLY IMPORTANT STUDY of state highway department management was reported last week: The Automotive Safety Foundation's appraisal of state highway policies and practices in Pennsylvania (ENR Sept. 4, p. 27).

This study is important as ASF's first detailed appraisal of highway management—after a score of earlier reports, largely on long-range objectives of the departments investigated. Further importance derives from the fact that Pennsylvania's highway agency is about as badly in need of changes in policy and practices as any state road department. Pennsylvania is found to be suffering from "political traditions . . . which go back to the early years of the century."

Fortunately, according to ASF, 25 states have the civil service structure that Pennsylvania lacks. Yet every state should heed the overriding recommendation of ASF's appraisal: Keep the highway department out of politics.

Transportation Policy Needed

IT IS INCONCEIVABLE that official Washington could be unconcerned about the nation's need for a sound transportation policy. Yet there is evidence that that may be the case.

Some weeks ago, Engineers Joint Council expressed its interest in the state of the country's existing transportation facilities, and proposed that an extensive study be undertaken with the objective of developing a sound policy for their future development. EJC, which had previously demonstrated its capacity for such policy studies by its work in the water resources field, thought that it could provide the expert manpower for a similar review and analysis of the nation's transportation needs. But it would need funds.

The suggestion that the federal government might have an interest in supporting such a study went first to James R. Killian, former MIT president and now top scientific adviser to President Eisenhower.

Mr. Killian, rightfully more concerned with missiles these days than with the more mundane modes of air, water and land transportation, referred EJC's proposal that it be authorized to do a comprehensive transportation study to the Director of the Office of Defense Mobilization. And subsequently, EJC had its reply. Owen Jones, Assistant Director for Transportation, turned down the proposal with thanks, seeing "no immediate prospect or need" for a study of transportation policy.

Such a statement is hard to take at face value at a time when highway construction is booming ahead, railroads are claiming poverty (and proving it in some cases), airlines are plagued with air-traffic control problems accented by the advent of the faster jet planes, and waterways are competing with one another as well as with the rails. In any event, Enoch R. Needles, who as EJC's president had handled the exchange of correspondence with Washington, believes that EJC should continue to maintain its concern over the lack of national transportation policy.

EJC now has asked its interested constituent societies to name candidates for a task group of perhaps 10 members, which will consider whether and how the council should pursue a comprehensive transportation study. This continued concern is commendable. It is to be hoped that EJC will pursue the subject and that it may yet find the governmental—or private—support required to finance the kind of study needed to guide the growth of the nation's vital transport facilities.

Real Partnership in the Making

REAL FEDERAL-LOCAL PARTNERSHIP in water resources planning and development is shaping up now in Texas, where local interests significantly are taking the initiative. Groundwork for the joint action was laid by the state-established Trinity River Authority. And the authority's work was financed through voluntary contributions solicited by the Trinity Improvement Association, another local group.

Some federal participation in the Trinity Basin is already well along in the form of upstream flood prevention and soil conservation by the Agriculture Department's Soil Conservation Service. Now, with $100,000 put up by Congress in the closing days of the session just ended (ENR Sept. 4, p. 26), the Corps of Engineers is moving in to check feasibility of the local plan insofar as it involves primary areas of Corps responsibility—navigation and flood control.

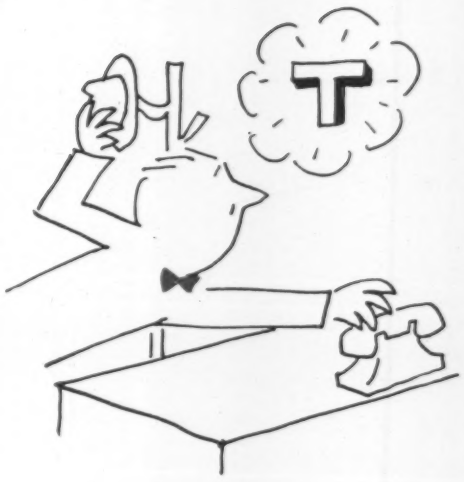
The Trinity River Basin, an 18,000 sq mi area stretching southward from Dallas and Fort Worth to the Gulf, has had, perhaps, more prodding from nature than most. The prolonged drought of recent years is still starkly vivid in the minds of most people of the area. The water situation is of high priority.

Importantly, the plan aims at ultimate exploitation of the watershed (as economically justified by today's standards). A basic assumption in the plan is that all the economically controllable runoff in the Trinity and its tributaries will be required eventually. The plan incorporates all phases of river use—flood control, navigation, soil conservation, domestic and industrial water supply, irrigation, recreation and pollution control.

In making this start toward a project in the national interest on local initiative, without waiting to take a ride on federal coattails, the Trinity planners have made a laudable effort—one well worth emulating. For the Trinity River plan is an example of what can be done at regional level on water resources.

1.

A vast and costly stadium was voted by the town.
Among the last to hear the news was able builder Brown.
He had returned that morning from a project out of state.
He groaned as he prepared his bid, "I hope I'm not too late!"

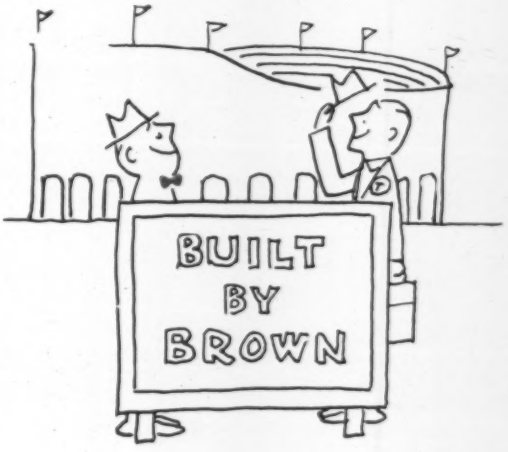


2.

He rushed to call his Travelers man, "Can you come out tonight?
That ball park bid! I need a bond. It must be *fast* and *right*."
The Travelers man replied, "Why, sure! Be at your house at eight!"
So Brown went home to wife and kids delighted with his fate.

3.

"How can you be so confident?" his wife asked with a frown.
"Because I trust my Travelers man," said happy Mister Brown.
"He's expert with those local laws that slow the bond you need.
He knows that time is money, so a bond arrives with *speed*."



4.

And right as rain and on the dot, Brown had his bond in hand.
Behind a signboard "Built by Brown" the stadium looks grand!
For fast and friendly service, think of Travelers when you plan.
A Travelers bond is always right. So call your Travelers man!

NOTE: *Comp, Equipment Floaters—Builders' Risk Insurance, too*
Are other ways The Travelers helps a contractor like you.

THE TRAVELERS
Insurance Companies
HARTFORD 15, CONNECTICUT

All forms of business and personal insurance including Life • Accident • Group • Fire • Marine • Automobile • Casualty • Bonds

U. S. Army photo

Why is a missile like a wheelbarrow?

IT might seem strange that one of the simplest means of transportation and one still in the future should have anything in common. But they do. Both have rotating parts. And both have Timken® tapered roller bearings.

Wherever any parts rotate in your equipment, on road machinery, cranes and machine tools, you'll find Timken tapered roller bearings. They practically eliminate friction—easing the path of motion, whether it be moving a third of a yard of mortar or a space satellite into orbit.

Timken bearings are made to various degrees of precision—more than ample precision for use in ordinary machines, jewel accurate for specialized, fine machinery. Their tapered design means they take loads from all directions—eliminate the need for bulky thrust devices. And full-line contact between rollers and races give Timken bearings extra load-carrying capacity.

Because Timken bearings are precision made (we even make our own steel to make sure we start with the best) they give long life with minimum maintenance. They keep production up and costs down.

Make sure you get all these advantages in the machines you buy or build. Specify Timken tapered roller bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN® TAPERED ROLLER BEARINGS ROLL THE LOAD

® TRADE-MARK REG. U. S. PAT. OFF.